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THREE LECTURES

ON

THE SURGICAL TREATMENT OF STONE IN THE BLADDER.

Delivered in the Royal College of Surgeons of England, June, 1886.

ALSO THE

ADDRESS ON THE ETIOLOGY AND DISTRIBUTION OF STONE IN THE BLADDER,

Delivered at the Annual Meeting of the British Medical Association at Norwich, August, 1874.

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BY

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LECTURE I.

Introductory.—Sounding.—Lateral Lithotomy in Adults: in Children.—Median Lithotomy.—Difficulties.—No Stone Found.—Encysted Stone.—Wound of Rectum.—Perforation of Bladder.

THE Council of the College having conferred on me the honour of giving these lectures, I have selected the subject of the Surgical Treatment of Stone in the Bladder, because it is the department of surgery with which I am most familiar. It may, perhaps, be thought that it has so often been treated of publicly, and more than once partially from this chair, that further discussion of it can neither be required nor right. But when I recognise the progress of opinion, and the changes of treatment which have taken place in my own time; when I contrast the first two cases of stone on which I operated in 1850, with the last two, only a few weeks ago; the former, a case of lateral lithotomy and a case of lithotrity in six sittings; the latter, a case of suprapubic lithotomy, and a case of lithotrity in one sitting; this contrast of proceeding will, I hope, in some degree, justify me in occupying your attention with the old, old subject of stone in the bladder.

I do not, however, propose to treat it systematically; that I have recently and briefly done elsewhere (*vide* Heath's *Dictionary of Practical Surgery*); nor to speak of the ætiology or geographical distribution of stone, a subject of great interest; that, too, I have partially discussed in an address on surgery delivered at Norwich, in 1874. Rather, I desire to travel through the subject, and to communicate such facts and hints as my experience may furnish; and, chiefly, I intend them for the possible assistance of my younger brethren. Assuredly, it is not my intention to enlarge on any successful work, but rather to point out some difficulties and dangers which beset the surgeon's course. I have the belief that, in the literature of this subject, we have heard over-much of the triumphs and successes, and too little of the obstacles and failures, which are incidental to bladder surgery. It is probable that more instruction and benefit are to be derived from a candid statement of our failures and mistakes than of our clever doings. In lithotrity especially, there is need for a fair and explicit account of certain drawbacks and defects which have been too little spoken or thought of by its partisans; drawbacks which the operation can well afford to admit in consideration of its brilliant achievements. Neither is it my intention to trouble you, to any extent, with statistics, for obvious reasons. They are often fallacious; the practice of no two surgeons is the same; one who, like myself, practices largely amongst the poor in hospital, must, of necessity, deal with very different cases from those treated by him who sees chiefly private patients of the educated and wealthy classes. In the one case, the poor unenlightened labourer seldom applies for relief so long as he can earn his daily bread, while the rich private patient will seek aid early; in the poor, the stone is apt to be large, and the urinary organs damaged; in the rich, the stone is probably small, and easily dealt with. One surgeon, like myself, will have most to do with stone in the aged; in my list of 300 cases, there were only 31 in children under 10, while 182 were over 60 years; while another, living, for instance, in one of the midland counties, will probably operate chiefly on the young. One surgeon refuses scarcely any cases, another refuses many; one includes amongst his fatal cases those who die from all causes during treatment; another, those only whose deaths are directly connected with, or caused by, the operation. Hence statistics, except for special purposes, have little or no general value.

As I am about to speak from the experience and observation of stone as it is seen around and in the Norfolk and Norwich Hospital, I may be allowed to refer briefly to a few of those who have done good work in that institution. Before, however, the hospital was erected, it would appear that, as on the continent, so in Norfolk, the offices of clergyman and lithotomist were sometimes associated. In the village church of Stoke Holy Cross, near Norwich, is a mural tablet to the memory of the Rev. Thomas Havers, "qui Theologia, Medicina, Chirurgia, et Lythotomia doctus fuit et expertus." He died in 1719, aged 60.

Benjamin Gooch, whose work, *Cases and Remarks in Surgery*, is a standard book to this day, practised in Norwich about the middle of the last century. He was a lithotomist of distinction, and a man of great erudition. He was one of the first, if not the first, who practised vaginal lithotomy, and he also advocated cystotomy for vesical diseases other than stone. He was one of the founders of the hospital, and was consulting surgeon to it, but without any active duties.

Mr. Donne was the first surgeon appointed to the hospital in 1772. He had two colleagues, but it would appear that Donne must have taken all the stone cases, for the names of the others do not occur in the museum-books. He must have been a very excellent lithotomist; his name and cases are frequently mentioned in Gooch's work; and, during his thirty-two years of service, he operated on 173 patients (a larger number than any of his successors, except myself), with a mortality of 1 in 7.

Mr. Rigby, the father of Edward Rigby, the gynæcologist, was surgeon to the hospital for twenty-four years, and then physician for another seven years. He operated on 106 patients. He was a man of strong intellect, and was the author of an admirable essay on uterine hæmorrhage.

Mr. Martineau, the writer of the well known paper on Lithotomy, in the eleventh volume of the *Medico-Chirurgical Transactions*, in which he reported 84 cases with only 2 deaths, was connected with the hospital for 50 years, during 35 of which he was full surgeon: he operated on 149 cases, with a mortality of 1 in 8. Very many were children, and he was known to be careful in the selection of his cases.

Mr. Dalrymple, the father of Mr. J. Dalrymple, the ophthalmologist, was surgeon to the hospital for twenty-five years, and operated on 90 cases with good success; in one case, the stone weighed 13 ounces, but he failed to extract it. Although a man of great ability, and enjoying a wide influence in the county, he was over-sensitive and nervous in his work as a surgeon, and was eventually unable to encounter great operations.

Mr. J. G. Crosse was undoubtedly the most distinguished of the surgeons who have flourished at Norwich during this century. His indefatigable industry, his untiring energy, and his habit of copious note-taking, and of critical commentary on all he saw and did and read, enriched his mind with abundant knowledge. That which he published bears but small proportion to the volumes he left of diaries and reflections, which richly deserve to be rescued from oblivion. His Jacksonian prize essay on Stone in 1835, with its solid body of information, its full illustrations, its appendix of important cases elaborately detailed, its statistical tables, and its full catalogue of works on stone and lithotomy in all ages, and in all languages, is a lasting proof of his great merit, and stamps him as one of the foremost of provincial surgeons. He was, for twenty-four years, surgeon to the hospital, and he operated on 52 cases of stone. This may seem to be but a small number for so eminent a surgeon, but it is explained by the curious fact that Dr. Lubbock, one of the hospital physicians, with a love for surgery, operated about that period on 85 cases of stone, chiefly in small private houses, and so depleted the supply of cases to the hospital that only one or two were admitted during several separate years.

I will not pursue further this biographical digression, but proceed at once to the subject before me.

Little need be said concerning the symptoms of stone ; they are generally clear and palpable enough, but sometimes they are conspicuous by their absence, and many a surgeon, led astray by this absence, has lost credit in consequence.

When the stone is small, and falls readily about the bladder, it seldom fails to cause some degree of pain and irritation ; but if the patient do not seek advice, and time go on, and the stone become a large one, the symptoms may become obscure, and it is the common observation of all surgeons that, occasionally, the largest stones produce the least trouble. Here, for instance, is a lithic stone, weighing nearly nine ounces, which was removed after death. The old man had little or no pain ; he never, I believe, consulted a surgeon, and died from another ailment. I found the bladder perfectly healthy, and lying loosely round the stone, which seldom moved.

Another cause of obscurity is the fixed position of the stone. I know nothing of what is called adhesion of the stone to the bladder, nor have I ever met with an instance in which it passed occasionally in and out of a cyst or sac ; but it is not very unusual to meet with cases in which the stone is held immovable by irregular contraction of the muscular columns. This large rough mulberry calculus was held in the upper fundus of the bladder ; the sound detected it there, and, at the operation for its removal, I was obliged to depress the handles of the forceps, and push the blades up behind the pubes. This gentleman had carried the stone for many years, during which he experienced but very slight symptoms ; he travelled much, both in England and abroad ; he occasionally called on an eminent surgeon as he passed through London; but so little did he suffer, that, for a long time, there seemed no excuse for sounding. Sometimes a stone case is mistaken for one of hæmorrhoids ; this is apt to be the case in old men with enlarged prostate. The piles probably exist, and the associated forcing action of the bladder and rectum will aggravate the piles, and induce the belief that they alone cause all the trouble. Hæmaturia is, of course, an usual accompaniment of stone ; it is generally small in amount, and is caused by movement in exercise ; but it is sometimes in large quantity, and is attended by so little irritation of the bladder, that no suspicion of stone is entertained.

Many years ago, I removed a stone, weighing two ounces, from a man who had twice been in hospitals under the physicians. The stone broke in the forceps, and large quantities of black material, like cinders, came away mixed with scales of calculous matter. It was found to be composed of alternate layers of dried blood and stone, with a nucleus of oxalate of lime. This man was cut a second time, eight years after the first, and a mixed phosphatic and lithic stone removed, and I believe he was operated on a third time by Mr. Teevan in London, where he came to reside.

Sounding for stone is by no means always a simple or easy proceeding, judging by the large number of cases in which the stone is undetected by the sound, and of those instances, also, in which it was said to exist, but in which it was really absent. Nor can it be said that this uncertainty is always due to inexperience; for I believe, and I could support this opinion by a good deal of strong evidence, that there is no surgeon, however great his experience and his manipulative dexterity may be, who has not now and again left a stone undetected in the bladder. I quite readily admit the failure in my own case, and admit also the feeling of chagrin and self-reproach which I have felt on being told of my failure.

The difficulty sometimes experienced in introducing a sound may be due to spasm; it may be the first time that any instrument has entered the urethra, and we all know how often a hitch is found at a first attempt, when no organic obstruction really exists. By far the most frequent cause of difficulty that I have noticed, however, is enlarged prostate; the altered course of the prostatic urethra, or the bar caused by hypertrophy of the median lobe, may make it especially awkward for the short sharp curve of a sound to find its way; but there is one cause of failure to find a stone which I have specially noticed, and by which even experienced surgeons have been misled. It is by sounding the deep prostatic sinus, and never reaching the bladder; the latter is at a great distance; the sound looks as if it were well in, and can be moved more or less from side to side; the bladder is assumed to be contracted; no stone is felt, and an erroneous opinion is given. If the suspicion do not cross the surgeon's mind that he has not reached the bladder, he will rest contented and mistaken; if it do, he will overcome the difficulty by well raising the patient's hips, well depressing the handle of the sound, and, by a semi-rotatory and firm forward movement, making it glide over the obstacle; if it will not do so, a sound, with a less abrupt curve, will probably pass. In this, and in all cases, the use of an anæsthetic will greatly facilitate the proceeding; but in these prostatic cases, and especially in children, it is almost essential.

I do not profess to describe the usual mode of sounding, but I may venture to remind my younger hearers that the object of sounding is much more than simply to ascertain the presence or absence of a stone; we not only do that, but we also ascertain the probable size and nature of it, and whether it is movable or fixed; the condition of the bladder as to irritability, capacity, softness or hardness, whether it is smooth or rugous; also, we note the size and prominence of the prostate. All this information the practised hand will endeavour to elicit, in order to select by what operation, if any, the calculus is to be removed. It is good that some, but not too much, urine should be present—perhaps the secretion of an hour or two. Children will not unfrequently, so much do they dread the pain in micturition, accustom the bladder to retain a large quantity; in which case, the coats of the bladder feel hard and rigid, the bony wall of the pelvis is immediately contiguous, and, between these two conditions, the sensation, but not the sound, of a foreign body is produced; while the stone itself, if one be present, is not easy to find. Very often, as the chloroform takes effect, or as the sound is passing, the bladder contracts, and a large quantity of urine is expelled with straining. Phimosis and other ailments will often give rise to vivid symptoms of stone in young children. Some months ago, I was requested to go to a distance, prepared to do lithotomy for a child three years old. When I stated to my medical friend that I had only once in my life met with stone in a child of well-to-do parents, he replied, that he had sounded, and felt no doubt of the presence of a stone of some size; however, no stone could we then detect, but simply a phimosis; this was remedied, the symptoms abated, and I have heard no more of it.

Sounding, as every one knows, may be followed by serious and even fatal consequences. Retention, prostatitis, orchitis, cystitis, and nephritis—any of these may ensue, and we are warned, and properly warned, against sounding patients who have to travel immediately after it. It is, however, almost impossible to adhere to this rule; patients come up from a distance, expect to be told what is amiss, and return to their homes; and, without an examination, it may be impossible to diagnose or treat their malady. A few hours' rest should be insisted on, with simple food and a warm drink, and, where retention seems likely, an opium pill and hot fomentations. Two fatal cases from sounding have occurred to me: one from nephritis when all proper precautions were taken, just as it may occur after a simple lithotrity or after the first use of the catheter for atonic retention; the other, a few months ago, from continued prostatic retention. The sounding was easy, a small stone was detected, the patient never left his room, but there followed the necessity for constant use of the catheter, which was attended sometimes with difficulty, and bleeding, and death in about a fortnight.

The presence of a stone having been assured, the question whether any, and what, operation for its removal presents itself, and I know of none more difficult, in many cases, to decide; this question, however, I will defer for the moment, and will suppose that the old lateral operation is selected. Its applicability is becoming more and more limited, on the one hand, by the adoption of litholapaxy; and, on the other, by the improved method of suprapubic lithotomy. Those surgeons who recognise the drawbacks incident to this method, or who are not expert lithotritists, will still march on the old lines for all moderately sized stones, and it is yet to be proved that any more successful operation has been devised.

Lateral Lithotomy.—Without describing the details of the operation, I may say that at Norwich we have followed in the main the method as performed there by Martineau and Crosse, and here by Liston and Fergusson. When I entered on practice in Norwich, now thirty-five years ago, I first saw the blunt gorget in use; by degrees it became restricted to those cases in which, from great enlargement of the prostate, or from great obesity, the finger could not reach the bladder, and soon it disappeared entirely; I never used it, and now I believe the hospital is without one.

Let me say a word or two as to the mode of holding the staff. Most authorities advise that it should be held perpendicularly, and hooked up under the pubic arch. Liston used to say, "you may almost lift the patient off the table with it," meaning that it would thus be well out of the way of the rectum, and held steady. When I was demonstrating anatomy at University College, I was struck, in making dissections of the pelvis from the perinæum and by vertical section, to see how easy it was to bring the membranous urethra nearer to the surface of the perinæum, by inclining the handle of the staff considerably towards the abdomen. By this manœuvre its point need not, and should not, be withdrawn from the bladder; but, if it were, it would be of no consequence, because it would re-enter it the moment the handle is raised; the membranous urethra, instead of being almost perpendicular to the surface of the perinæum, as it is when the staff is held upright, is brought down almost parallel with it, and is much easier to find with the knife; there is no inducement to open the urethra too far forward, and consequently less risk of wounding the bulb or its artery. The staff gets a steady rest against the front of the pubes; there is no danger to the rectum at this stage, the left forefinger is in the wound, the knife is close to it, and the bowel is guarded by it. As soon as the knife's point enters the groove, the staff is raised and hooked well up under the pubic arch, and the knife is carried on into the bladder, quite to the end of the groove. I did my early operations with the staff held in this manner—it was described in a short paper in the BRITISH MEDICAL JOURNAL; and I am so convinced of the facility it affords to the operator, and especially to the beginner, that it has been adopted by the members of the hospital staff ever since.

As to the deep incision, about which much has been written, I can only say that it should be moderate, but sufficient; it is useless to waste more words about it. I believe that, in many operations, the neck of the bladder is not incised at all, the knife being carefully drawn back in the same line as it was introduced, half hidden in the groove of the staff. Some division of the prostate is necessary, and my plan is to make it as the knife is withdrawn, outwards and downwards. Experience alone can guide the surgeon, and even with experience he may do more or less than the size of the stone calls for; it is better to do less, because the knife can easily be re-applied if extraction of the stone is difficult; if more be cut than is required, the danger is, not so much of inducing urinary infiltration, as of dividing some of the plexus of vessels which surround the prostate, and so causing very troublesome hæmorrhage.

The finger follows the knife immediately; the stone is felt; and then comes what I have always deemed to be a very important step in the operation; namely, the dilatation of the deep part of the wound by the finger. Liston used to accomplish this while he seemed to be selecting the forceps, pulling the bladder down and pressing forcibly with the finger in all directions. In this I believe he imitated Martineau, who made this a special feature in his operation. Mr. Crosse says, "the staff being withdrawn, Martineau was accustomed to introduce his left forefinger (which was particularly long and large) into the bladder, forcibly dilating the opening and using the finger as a powerful but safe instrument for rendering the neck of the bladder ample to admit the forceps. The force and determination with which the finger was then used, dilating if not lacerating the undivided portion of the prostrate gland and the neck of the bladder, I always regarded as a particular and intrinsic part of his operation."

I have often thought that some special means might be adopted slowly to dilate the deep part of the wound. Such an instrument as this—a Todd's dilator for the rectum—would, by its smooth surfaces and gradual extension, make the prostate yield to the very utmost before lacerating. Professor Ellis has shown, by his excellent dissections, that the so-called gland is very largely composed of muscular fibres (*Medico-Chirurgical Transactions*, vol. lxxxix); and we all know to what a great extent the sphincter and other muscles will yield to slow and forcible stretching. Let the dilatation, however, be as slow and careful as possible, laceration will take place if the stone be of any considerable size, or if it be awkwardly seized. When splitting does take place, it is always at the rectal aspect, between the two lateral lobes, and not through the left lobe, where the knife has traversed. Who has not felt, when a full-sized stone has been dragged through a large prostate, the unmistakable sense of yielding? and, when the finger is introduced, there are the two lateral lobes, and a rift, or sense of nothing, towards the bowel. If the resistance to extraction be great, and the yielding just spoken of do not occur with moderate tractile force, it is the common and good practice to re-apply the knife; and the only question is, what is the safest and most serviceable direction in which to cut? The majority of surgeons and writers recommend a division of the right side of the prostate; but Martineau, Crosse, and the Norwich surgeons generally, have made the further incision in the same direction as the first. It may, indeed, be made in any direction; but it has always seemed to me best to keep to the first line of wound, and cut, by little and little, until the stone shall come through with moderate force applied. The motive for cutting on the right side was the fear that urinary infiltration might follow the too free division of the base of the prostate and its enclosing fascia; but now we know that infiltration of urine is seldom the cause of death after lithotomy, and I know of no fascia, at the base of the prostate, other than that which encloses it altogether. The one objection to this left side extension of the incision is, that the numerous veins which surround the gland may be cut, and lead to hæmorrhage, which is difficult to arrest; and this has always made me not averse to obtain the necessary room by splitting.

Let me advert, for a moment, to those cases in which, either from the great size of the prostate, or the great amount of fat, the finger cannot reach the bladder. I have often thought that very fat people are unusually prone to stone; and, I might add, to diabetes. Within the last three years, I have cut three men, who each weighed about 18 stones. Brodie speaks of a patient, from Norfolk, who was so large and fat that he was obliged to have a lithotrite of extra length expressly made for his case; and it fell to my lot to attend the son of this gentleman, who weighed 24 stones, and who died of suppression of urine, due to calculous obstruction of the ureter. Whatever may be the cause, the inability to reach the bladder is a serious drawback. You cannot tell the size and shape of the stone, or the precise condition of the vesical orifice; and, what is of more importance, should there be several stones, or a breakage of one, there cannot be absolute certainty of entire clearance of the bladder. In my earlier operations, I used to be somewhat disconcerted by this difficulty; but it has so often occurred, that I am quite familiar with it now. I have never resorted to the gorget as a guide to the forceps, but have introduced the latter over the finger, and have scarcely ever found any difficulty in reaching the bladder with them. Should the stone, as well as the prostate, be of full size, and the patient fat, an association of evils by no means very unusual, in such a case the chiefest difficulties of lithotomy are accumulated; and it will require the utmost care and steadiness to overcome them, and do the least amount of injury.

In very large stones, the prostate is seldom much increased in bulk, the stone seems to weigh down the neck of the bladder, and is readily approached, if not easily removed. It has never been my lot to encounter a huge calculus, such as are to be found in every museum; the pleasant idea has been suggested that, in these enlightened days, when medical education has reached a high perfection, and when the fear of operations is allayed by anæsthetics, stone, if not stamped out, should be detected when it is small, and easily cured without lithotomy; yet even in this very year, stones weighing respectively twenty-five, twenty-three, and fourteen ounces, have been met with. I find that, a hundred years ago, the first fifty adults cut at the Norwich Hospital had an average weight of stone of 765 grains, the average age was 47, and there were thirteen deaths. In the last fifty, the average weight of stone was 590 grains, the average age was 64, and there were eight deaths. It should, however, be remembered that, during the last period, a considerable number of cases in which the stones were small were relegated to lithotrity; still, the difference is not so much as might have been expected.

Lithotomy in Children.—To go from great things to small, I desire to say a few words on lithotomy in children, chiefly with reference to the difficulty of passing the finger along the staff safely into the bladder. Sir W. Fergusson described the difficulty so well, that I will quote his words. He said: "In March, 1849, I had to operate on a boy, aged 4. I used a scalpel, and made the usual incision. In making the deepest part of the incision, I purposely used the knife as lightly as possible, with a view to open only a part of the membranous urethra, and notch the prostate and neck of the bladder. These objects being effected, the point of the left forefinger was, as usual, placed on the staff, and pushed gently towards the bladder. The finger went on, but I was aware that it had not got between the urethra and staff. With an insinuating movement (much to be appreciated by the lithotomist, who, as I do, professedly makes a small incision in this locality), I endeavoured and hoped to get its point, as usual, into the urethra and neck of the bladder. But here I felt conscious that I had failed, and was aware that the finger was getting deeper as regarded the depth of the perinæum, but that I was not materially nearer the bladder. I could feel a considerable space at the point of the finger, and was convinced that the upper part of the membranous urethra, as well as the sides above the wound, had given way to the pressure, and that now, as the finger was getting deeper into the wound, I was only pushing the prostate gland and neck of the bladder inwards and upwards. These parts seemed to recede before the smallest imaginable force, whilst I felt that I could, in a manner, make any amount of space round the bare part of the staff. I had no difficulty in distinguishing between the surface of this space and that of the mucous membrane of the bladder. Moreover, I knew that I had never crossed that narrow neck which is always felt as the finger passes into the bladder when a limited incision is made. An impression came over me that I was about to fail in getting into the bladder, and I had an idea that, unless I could open the urethra just in front of the prostate more freely, I should probably never reach the stone. This I effected with great caution, and then I could appreciate the passage of the finger, as usual, through the neck of the bladder. The stone was thereafter easily touched and removed; but, when all was finished, I was forcibly impressed with the idea that I had nearly failed in the performance of the operation." Fergusson was a master of the art of operative surgery; and, if the difficulty occurred to him, we may conclude that it is not unlikely to occur to any of us. He was under the impression that the difficulty had never been described before he mentioned it in 1864; but, in Crosse's book, published in 1835, there is a case exactly similar, with this addition, that the staff had been removed before the bladder was opened, whereas Fergusson recognised his error in time, and remedied it by a further incision.

I have seen this misadventure in several cases; in one, the staff was withdrawn; it could not be reintroduced; the stone was not removed, and the child died. One of these cases occurred to a very experienced operator—Keith, of Aberdeen. He was on a visit to me, and having two stone cases, I invited him to do one, a child aged 3½. This was in 1862, and I find, in my notes, that "he quickly bared the staff, laid aside the scalpel, used a probe-ended bistoury, and ran it along to the end of the groove, but could not find the bladder with his finger. The staff was carefully replaced in the bladder, a further division of its neck made, and two stones easily removed." How is this mishap to be avoided? I have just stated how Ferguson and Keith overcame it by a further incision; but there must be a limit to even free incision, and my object in discussing this matter is to point out another plan which I have frequently adopted, and I can best describe it by relating the only case in which this difficulty has occurred to myself. It was many years ago when I first began to operate; the patient was an infant, only 1½ years old. I felt the impossibility, even with a fair incision, of distending the wound with my finger—it was like trying to get it into the orifice of the urethra; I therefore desisted before doing any harm, and, taking a pair of common dressing forceps, I passed them easily along the staff into the bladder; by opening the blades gently but firmly, room was gained, and the finger entered, and made room for a small lithotomy-forceps. But I have repeatedly, after passing the dressing-forceps, withdrawn the staff, and removed the stone with them, without introducing the finger at all. I can recommend this manœuvre, as both safe and efficient. I dare say it has been adopted by others, but I do not find it alluded to in modern text-books.

In older children, as in boys from 6 to 12, this want of room for the finger is still manifest. Pressure will probably overcome it, but I have sometimes pursued a method which renders the passage of the finger quite easy. Having made the requisite incisions, place the tip of the finger on the groove, and then direct the staff to be withdrawn; this being done, worm the finger along the empty urethra gently, and you will feel it glide along, dilating as it goes, until you place it on the stone; it is then used, as in the adult, to press and stretch the neck of the bladder in all directions. If the stone be found to be large, or the division of the neck of the bladder insufficient, nothing is easier than to slip a bistoury flatwise, alongside the finger, and extend the cut a little outwards and downwards. This plan I know contravenes that inflexible rule of never withdrawing the staff until the finger is in contact with the stone; but inflexibility does not always imply wisdom, and, I can answer for it, that it is much easier to pass in the finger through the empty urethra, than by the side of a large staff. The possible objection would be that the finger might perhaps wander elsewhere than into the bladder; but where could it go so easily as along the wound and open urethra, through which it passes as it would into a kid glove, and does not bruise, lacerate, or injure any part?

Median Lithotomy.—I need say but little on this subject. Some years ago we, at Norwich, gave the plan a good trial. I believe that for some years there were very few lateral operations; nearly all were done by the median method, but by degrees it came to be almost relinquished, and now it is very seldom practised there, for these reasons. By it there is not room enough to deal with stones of any considerable magnitude; the rectum on the one hand, and the bulb and its artery on the other, are both in greater danger of being injured than in the lateral operation; troublesome bleeding is more frequent; the wound being small, you cannot bury the knuckles in it and reach the bladder as easily as in the larger lateral wound; and therefore, having done fifty to sixty cases by the median plan myself, and having had rather a higher mortality than by the lateral, I am not disposed to continue or advise it, except in particular cases; cases in which the stone is small, and in which, for some good reason, lithotrity is not available. While, however, I should seldom resort to it, I must admit that I have seen a quite considerable number of instances of it in which recovery has been marvellously rapid; the urine has resumed its natural route almost immediately after the removal of the tube; the wound, instead of gaping and healing slowly as the lateral wound does, falls into accurate apposition naturally, and heals almost by first intention. All this, however, does not compensate, in my opinion, for the disadvantages just described. Some surgeons, I believe, still retain a preference for it, especially in children; but my observation and experience would lead me to say, avoid it generally, but especially in children, in whom, comparatively speaking, a free incision is necessary in order to facilitate the passage of the finger into the bladder, but in whom the limit of space for the knife is very small indeed.

Other methods of lithotomy have been practised; namely, the medio-bilateral; the recto-urethral or recto-vesical; various directions of the external and deep incisions; the combination of perineal lithotomy and lithotrity, etc. These various proceedings have never found much favour in this country; and, as I have no personal experience of them, I may pass them by. The suprapubic operation I will speak of by-and-by.

Difficulties.—Let me, however, refer to some of the troubles and accidents which may occur during and after lithotomy. The staff may fail to touch the stone; this will seldom occur, but, should it do so, a sound will probably at once detect it, and the operation may proceed. Should it, however, elude the sound, it will be right to postpone the operation for a few days. I have never had to do this, but I well remember that, in a private case of Liston's, the operation had to be postponed twice. This was annoying, seeing that preparations had been made, assistants had come some distance, and the patient and his friends were disappointed by the delay. On the third occasion, the stone still could not be felt by either staff or sound, although it had been clearly detected the day before. The operation was done. The patient was a large fat man, with hypertrophied prostate, and the finger could not reach the bladder; the forceps was used, but no stone was felt. Practically, however, two stones were unconsciously removed, so enveloped in a clot of blood, that they did not communicate any sense of touch to the operator. Once, and once only have I seen the bladder opened and no stone removed; but that case impressed itself on my memory, not only because of this awkward incident, but it was also the first case I ever witnessed at the Norwich Hospital. The surgeon, now deceased, was a good and experienced lithotomist, and after trying various instruments—I do not think he syringed the bladder, which would probably have washed the stone out—he desisted, and the stone came away with the urine a day or two after the operation In this case, too, the stone was small; and I apprehend that the difficulty arose from its having got into some recess of the mucous membrane, or having been held by the muscular columns in a part which the finger could not reach, and enveloped in clot. These, however, are but curiosities of experience, and can but very rarely happen.

Encysted stone, too, is, happily, a rare occurrence; but, on looking through my notes, I find records of five cases in connection with lithotomy, and as many, or more, with lithotrity, of which, however, I will not now speak. The mode of formation of cysts, or sacculi of the bladder, is too well understood to need explanation; they are due, in all cases, to obstruction to the easy outflow of urine, and by far the commonest cause of obstruction is enlargement of the prostate gland. When sacculation of the bladder co-exists with stone, this has been by some thought to be the cause; but, inasmuch as sacculation of the bladder very frequently, indeed generally, exists more or less completely in the bladder of old people whose prostate is enlarged, where no stone is present, so I conclude that the co-existence of stone and sacculation is only a coincidence, and that the utmost which can be said is that stone may add to the completeness of the sacculation by increasing the irritability of the bladder, and its vain efforts to overcome the prostatic obstruction. Moreover, stone in the young and middle aged seldom exists with sacculation.

The fact of the stone being in a sac or cyst can seldom be accurately diagnosed, but it may sometimes be shrewdly suspected. The pain is felt more in the bladder itself than in the glans penis; there will be unusual difficulty in finding the stone; and, when found, probably only a point of it can be touched, and it cannot be moved. This fact of always finding the stone at one spot, where it seemed to be fixed, has several times led me to make an accurate diagnosis, more especially if that spot were somewhere near the right ureter, which, I believe, is the most frequent place in which to find an encysted stone. If there be chronic cystitis, the point of stone which projects into the lumen of the bladder becomes covered with phosphatic deposit, so that there are two stones, one composed of uric acid, the other of phosphates, connected by a narrow neck ; the phosphatic part is often broken off by the movements of the bladder, and again a fresh mushroom-like deposit of phosphates grows up from the broken neck ; and in this way is explained the occurrence of one stone lying free in the bladder in addition to the encysted one.

In 1860, a man, aged 30, was cut by my colleague, Mr. T.W. Crosse, and a cup-shaped phosphatic stone was removed ; it had clearly formed over some projecting surface, and, on searching, the finger detected a round smooth substance at the base of the bladder; its exact nature could not be made out, and it was left. The patient rapidly recovered, and remained well for a year. Symptoms of stone then returned, and he was again admitted into the hospital, by chance, under my care. One stone, which was free in the bladder, having been removed, the forceps then grasped the substance above mentioned, and, with very little force, it was extracted. It proved to be an encysted stone, covered only by mucous membrane ; it was pear-shaped, about the size of the end of one's thumb, and had on it at one end a nipple-like process, which protruded through the opening of the cyst into the bladder. The stone lying free was composed of white phosphates, and that in the cyst of brown uric acid. The patient suffered nothing from the injury to the mucous membrane, and was almost well in a week. This, however, was not a typical case, although a very interesting one, and one the like of which I have never seen in museums or read of in books. The mucous membrane was not, as in true sacculation, forced through the muscular wall, so as to be, as it were, outside the bladder ; the patient was only aged 30 ; had, of course, no prostatic enlargement, and no obstruction to lead to sacculation. The stone, as I have said, lay directly beneath the lining membrane, bulging it up, and communicating with the cavity of the bladder by a narrow opening. I know not how to explain its mode of formation. These sacculi, however, although they are generally complete, and are formed of only the mucous membrane and peritoneum, in which case they may reach any size, larger by far even than the bladder itself, may, when small, consist of all the coats of the bladder. They may be numerous or single, large or small, and in any part of the bladder ; but when they exist, and when, in addition, a stone passes down from the kidney, they form a very present danger, lest this wee stone should be entrapped in one of them. It is true that their communication with the general cavity of the bladder is small, and is almost closed by the interlacing muscular columns ; but it is impossible to overlook the risk that, as the urine constantly passes into them, when there is distension of the bladder, so, every now and then, will a stone or piece of stone, no larger than a millet-seed, find in them a resting-place too, to the future trouble of the surgeon, and the probable ruin of the individual.

The records of surgery contain many instances of gallant encounters with these hidden calculi ; too often they resist all attacks, and the surgeon has to acknowledge his defeat ; and, when his resolute endeavours have been crowned with success, too often it has been at the cost of the patient's life. I have failed, as others have, in these cases ; but two instances may be mentioned in which the stones were removed, because they exhibit points of interest, and perhaps hints, for the guidance of others.

In 1862, a man, aged 58, applied to me, having a piece of stone impacted in the urethra near the meatus ; this was extracted, and he showed me other pieces which he had voided during the previous years ; he had never had an instrument passed, and they were the product of spontaneous disintegration of a stone. In the bladder, there were indications of multiple stones. He was cut by the median method, and five calculi, weighing thirteen drachms, composed of urate of ammonia, were removed. He recovered, and remained well for six years; then his symptoms returned, he re-entered the hospital with persistent cystitis, and a small stone was detected. A lithotrite was used, but the stone could not be properly seized, and only some soft phosphatic matter was scraped off it. A second trial was made, but with no better result; the stone seemed to be fixed at the lower and right side of the bladder. He was again cut median-wise; the finger could hardly reach the bladder, owing to prostatic enlargement, but the stone was felt at the lowest part of it. Small forceps broke off portions of phosphates, but still I could just nibble with my finger-nail the small stem of an encysted stone embedded amongst the folds of mucous membrane. With a stick-sponge, well oiled and pushed up the rectum beyond the prostate, I could elevate and pull the bladder forwards, so as to reach the stone more easily, but not sufficiently to raise it out of its bed. A small forceps, however, grasped and brought it away with a portion of mucous membrane, sabulous matter, and mucus. It was dark-coloured, small, and had a narrow neck, with a fractured surface, from which the white phosphatic bladder-stone had been broken. The bladder was well washed out, and searched, but no more stone could be felt. He recovered fairly well, but, in a few months, his old symptoms recurred; he was examined with a lithotrite, and a soft stone was detected, just as before, on the right side of the bladder, and fixed, so that it could not be grasped. Feeling sure that this stone was encysted at that spot, and thinking that a little better approach to it would be obtained, I performed lateral lithotomy on the right side, with my left hand; it was awkward, but the bladder was quickly reached, and, with the utmost stretch of the right forefinger, I could just feel the point of the stone; the left finger could not reach it, and, with the right, the knuckles were so buried in the wound, that no instrument could, at the same time, be used. Forceps would not seize or even touch the stone, but I succeeded in slipping a narrow sharply curved scoop, along the back of the stone down into the cyst; then, finding the scoop had a good hold, by pulling it towards the perineum, and giving it a half turn, the stone was dislodged and brought into the wound, and easily caught by forceps. It was oval, pointed at one end, marked by slight circular grooves, where the mucous membrane around the orifice of the cyst had clipped it. This operation was followed by cystitis, and the discharge of some soft phosphatic matter, but he entirely recovered, did not have any recurrence, and died, some years after, of paralysis. The practical hints to be drawn from this case were: that cutting on the right side gave rather a freer access to the stone, and, also, that tilting up the rectum and base of the bladder facilitated the operation. In the present day, we, perhaps, should use a rectal bag moderately distended, or, better still, should have recourse to the suprapubic operation. Dr. Humphry has recorded a case, almost the very copy of this, in which he met with the same conditions and the same position of the stone. He performed lateral lithotomy four times, but could not, on the last occasion, extract the stone. On the fifth recurrence, he resorted to the recto-vesical plan, and succeeded in enlarging the mouth of the sac, with a hernia-knife, and removed the stone with forceps; but, unfortunately, this entailed rupture of the cyst-wall, and death of the patient. Dr. Humphry also records another case, in which, at a second operation, he enlarged the opening into the sac, and extracted the stone with forceps, and complete recovery resulted.

The only other case with which I will trouble you was in a woman, aged 61, who came into the hospital two years ago. She had difficulty in micturition, owing to a thickening and swelling around the orifice of the urethra; this was clipped off with scissors, but still the pain and irritation remained; and, on sounding, a stone was felt lying free in the bladder, and in addition, there was a hard lump to be felt with the finger in the vagina, which I took to be a stone in a cyst. She was in a low weak state, and the urine was alkaline, thick, and fœtid. The urethra was dilated, and the stone, lying loose, and about the size of a chesnut, was easily removed. Again using the finger, I could detect the encysted stone, and on trying to dislodge it, the part which projected into the bladder was broken off and removed. Then it was not easy to find the broken stalk, as it lay embedded in folds of membrane; but when it was found, I dilated the orifice of the cyst with the finger, and, guiding a narrow scoop into it, and at the same time tilting the stone up with another finger in the vagina, I easily drew it out of the sac, and removed it with forceps. The woman died of peritonitis in a week, and the *post mortem* examination showed that the bladder was rather thick and contracted; there were two sacculi, one as large as the bladder itself, communicating with it by a round aperture in the centre of the posterior wall; this sac was thin and sloughy, and was the starting point of the pelvic peritonitis which proved fatal; the other sac, much smaller, was that from which the stone had been removed; it was situated close to the right ureter; it contained some creamy pus, and the orifice had contracted, and bore no sign of my manipulation, nor were there any indications of inflammatory mischief around it. This is the only instance of genuine sacculation of the bladder and encysted stone in the female that I have met with.

These cases, with a few others like them, which I have met with but have not now described, are numerous enough to form almost a class, having many features in common, and worthy of being specially noticed, because they will probably occasionally occur to those who may be frequently called on to treat cases of stone.

They differ entirely from those in which the stone lies embedded and fixed in a recess or pouch; the true cyst which I have been describing is a hernia or protrusion of the mucous membrane between and through the muscular fibres, but the pouch is simply a bulging of the entire bladder-wall in some direction, in which hollow a stone, frequently a large one, is fixed and embedded. This is sometimes seen in women, when the bladder wall and stone are more or less prolapsed towards the vagina; or, in men, when the stone lies almost fixed in a pouch behind an enlarged prostate; such a case, for instance, as that described by the late Mr. Southam, in which he successfully removed a very large calculus from this situation by the recto-urethral operation.

Wound of the rectum is an accident which, I suppose, has occurred to all lithotomists; generally it betrays a fault on the part of the operator, but it may be an unavoidable incident due to sloughing, following the extraction of a large stone. I have sometimes traced it, I believe, to the pressure caused by a plug used for restraining hæmorrhage; and it is more liable to occur during the median, than during the lateral operation. The surgeon who wishes to avoid this fault, should observe caution on three points: namely, to guard the bowel with the left forefinger as much as possible; to direct the staff to be well hooked up against the pubic arch during the deep incision, and to lateralise the edge of the knife well and cut away from the bowel. Against this last rule I am disposed to accuse myself of having offended; and when we remember how the old surgeons speak of directing the first incision towards the left hip, and of their sometimes cutting the trunk of the pudic artery, I am led to think that they kept more clear of the rectum than we do now. The part most in danger is the ampulla, just above the internal sphincter; and, seeing how close is the anatomical relation of the two canals, we ought not to be too quick to attribute blame or express surprise at the occasional occurrence of this accident. I have only one hint to give by way of remedying this mishap: namely, to wait for a long time before resorting to caustics or to division of the sphincter. Nature seldom fails to bring about a cure, or so to contract the wound as to leave but trifling inconvenience.

Perforation of the bladder.—I have twice witnessed this accident, once by the elbow of an assistant striking the handle of the staff while the anklets were being locked, and so driving its point through the posterior wall; and a second time, by either the point of the staff or the knife being carried too far across a contracted bladder. The accident has been attributed to the rough use of the forceps; but this, if it ever happen, must surely indicate a degree of violence that could only be used by a wild and nervous operator.

LECTURE II.

Hæmorrhage after Lithotomy.—Stone left behind.—Various Symptoms —Causes of Death.—Recurrence of Stone after Lithotomy.—Stone in the Female.—Suprapubic Lithotomy.

Hæmorrhage during or after Lithotomy.—A few years ago, in a paper by an eminent lithotomist, written chiefly to advocate a novel method of arresting bleeding, he mentioned having adopted it six times in twenty cases. I felt some surprise that he should have had so large a proportion of cases of bleeding. On looking over my own list, however, I was equally surprised to find that, out of 168 cases of lithotomy, there were nearly forty in which bleeding was so troublesome as to need special means to arrest it. In many of these, it was wholly unavoidable, but in some, I am free to admit that it was due to the fault of opening the urethra too far forward, and so cutting either the bulb or its artery. Sir H. Thompson says that the knife may be made to touch the staff at the first incision, and that it is pleasant to feel it do so. I have experienced this pleasure ; I remember it in my very first case : the operation was quick, and apparently satisfactory, but the patient had troublesome bleeding and made a tedious recovery. This interference with the bulb and its artery should, I think, be deemed to be a mistake ; for it in no way facilitates extraction of the stone, and an unnecessary incision is always an evil. Liston, who, take him for all in all, was probably the best lithotomist of his day, seldom had any serious hæmorrhage in his cases ; and it was a feature of his operation that he was never in a hurry to reach the groove of the staff, and always entered it at a considerable depth. Indeed, he sometimes erred in the opposite direction ; for, in his very last case (a thin elderly man), who recovered from the operation, but died a month after it of erysipelas of the head and face, we found that the urethra had never been cut at all ; but that he had worked his way by the side of it into the bladder, and then struck the groove. This fault, however, never probably befel him before ; the man was thin, the prostate small, and the bladder at no great depth.

However it occurs, whether from the transverse artery of the perinæum, from the bulb or its artery, from the venous plexus around the prostate, or from the separation of sloughs at a later period, bleeding, to any considerable extent, is a real evil, and may prejudice the recovery of the patient, either by its lowering effect on the vital power, or by the indirect effect of the means adopted to arrest it. Combined with the shock of a great operation, it may cause death in a day or two, or, by its repeated occurrence, in one, two, or three weeks. I notice that, out of these forty cases of hæmorrhage, there were twelve deaths, and some of them I attributed to the consequences of the restraining plug. Whether we use the air-tampon or the umbrella-cannula, or, as we in Norwich prefer, simply long pieces of dry lint, pushed carefully in alongside the silver tube, there is this risk : the plug prevents the flow of blood externally, but it is well-nigh impossible to plug a lithotomy as effectually as an ordinary surgical wound, and the blood is apt to infiltrate into the cellular tissue in the pelvis, and extend sometimes along the ureter towards the kidneys, or around the bladder towards the abdominal wall, even so that a faint yellowish colour, as of a bruise, may appear on the skin, near one groin. Decomposition may take place in this extravasated blood, and lead to pelvic cellulitis and abscess. So much objection have I to a plug of any kind, that I have often in hospital-practice, where a surgeon and good nurses are at hand, put a piece of ice into the wound, held it there with a sponge, and allowed the patient to be removed to bed while some degree of bleeding was still going on. Frequently, the oozing, free though it be, will cease in an hour or two ; sometimes, however, it will cease at first ; and, as reaction comes on, so does the straining and expulsion of clots. Then, when it is clearly shown to be necessary, the plug is resorted to, and seldom fails.

There are cases, however, in which no form of plug is effectual. A few years ago a young man, aged 22, consulted me three weeks after his marriage, with all the symptoms of stone, which had been going on since boyhood. I removed, by lateral lithotomy, a round rough mulberry stone, which weighed an ounce and a half. The bleeding was moderate at the time, but in two or three hours the straining and extrusion of clots made the plug necessary. On my return, in the evening, from a journey, I found him deadly pale, and the bleeding still going on ; a fresh plug was applied, and all went well for some days ; the tube and plug came away, and clear urine flowed. On the fifth day a few coagula escaped, next day some more; still nothing was done, and on the eighth day there was no bleeding ; on the ninth, however, it returned, and he became blanched and faint. I reintroduced the silver tube, drew off half-a-pint of urine, and tied it in ; in a few hours there was more blood, and the tube was blocked. It was removed, and the air-tampon was introduced ; still blood and urine escaped through the tube, forcing came on and continued, so as somewhat to displace the tampon. Seeing this, and seeing also that the bleeding was a slow oozing into the bladder from some deep source, it appeared useless to repeat the plugging, and I determined to trust to passing a large flexible catheter through the wound every two or three hours, so as to keep the bladder quiet. At this time, I first learned that he was of an hæmorrhagic diathesis, very liable to free epistaxis, and that every little cut bled freely and stopped unwillingly. On the tenth day, he had a considerable discharge of coagula; then it ceased entirely, and he recovered rapidly. When the artery of the bulb is the source of the bleeding, difficulty will be found in applying a ligature at such a depth in so narrow a wound ; but I have sometimes found that the pressure-forceps used in ovariotomy will control it, and may be safely left in the wound for a day or two.

Bleeding which comes from a deep source and passes into the bladder, and is expelled with straining, in the form of coagula chiefly, is very difficult to deal with ; the tampon or plug will scarcely arrest it, and the only caution I can give is to keep the bladder as quiet as possible, by passing a large soft catheter through the wound as often as necessary. It may be kept in permanently, but, when this is attempted, it is apt to become choked with blood and inefficient. It is possible that moderate dilatation of the whole wound by a Todd's rectum dilator, or by a full-sized gum-elastic bougie, having a central passage for a catheter, as recommended by Mr. Reginald Harrison, might succeed in these troublesome cases; but I have no experience of either of them, nor have I any of the injection of hot water, which has been found so efficient a hæmostatic in other wounds.

Stones Left in the Bladder after Lithotomy.—Leaving stones or fragments of a stone in the bladder after lithotomy is an accident which may greatly hurt the credit of the surgeon, and is assuredly a great misfortune for the patient. I believe this mishap to be of more frequent occurrence than is commonly supposed; it has occurred to me repeatedly, not only when I was younger, but even of late years, when I have been most fully alive to the risk, and have used every possible means to avoid it. It is especially liable to happen in old men, whose prostate gland is enlarged and the bladder honeycombed and ill-shaped; the finger is probably unable to reach and explore the bladder, small stones or fragments become enveloped in soft clots, or hidden in the recesses of the bladder; they may give no sound or sense of contact to the searcher, and the vigorous use of a syringe, although most proper and necessary, will not certainly insure their expulsion. There is a general belief that multiple stones are smooth and facetted, but this is by no means always the case. Here, for instance, are two stones, each weighing nearly an ounce: neither is particularly smooth, and yet they lay together loose in a man's bladder for several years. Sometimes a large and a very small stone exist together; and it is very conceivable that the smaller, unless it escape with the larger one, should be unsuspected and elude detection. Generally, multiple stones are about the same size, and grow pretty equally; but it may happen that, when a stone of considerable size occupies the bladder, an attack of renal colic may take place, and a fresh stone descends into the bladder; and thus this unequal size is explained. It has more than once occurred to me to witness an attack of renal colic, while a patient was under treatment by lithotomy or lithotrity.

With these several conditions present in his mind, the surgeon cannot be too wary of this danger, both for his own and the patient's sake. He should not consider that the operation is over when a stone has been removed; he should at once ask himself if, possibly, another, or more than one other, may yet linger in the bladder. Especially he will think of this if the stone have broken in the forceps, or if he have had several stones to deal with. He should deliberately and repeatedly examine with finger and with sound, and explore every corner of the bladder. He should use a good enema-syringe, with a small tube, which will allow a free return-stream; or distend the bladder with a larger tube, and then, by withdrawing it, allow the water to escape with a rush, which will bring any small piece of stone with it. Again he will use the sound after all clots and mucus have been washed away. In this manner, he will do his utmost to clear the bladder entirely, and will not consider appearances or the time occupied; for, with anæsthesia, time is of little moment.

In these cases, where several calculi have been removed, or a soft one broken, a most narrow watch should be observed during recovery. In ordinary cases, there is very little pain or straining after the operation; when they do ensue, the surgeon should look closely to ascertain the cause; if they come on soon after the operation, they may be caused by coagula or urine retained in the bladder, or by an en- rged prostate, still more swollen from rough handling, or by cystitis. These causes will quickly abate; the blood dissolves or escapes, urine is drawn off if and when necessary, the bruised prostate becomes uiet, and the cystitis subsides under proper treatment. The irritaion caused by a portion of stone left behind is slower in coming on, nd less vivid in its effects; it may escape with the urine in a few ays; or, the bladder becoming easy by the removal of the bulk of stone, and the patient resting quietly in bed, it is more likely to remain, and cause but little trouble for a short time. It is not unfrequent in old men with a weak bladder and enlarged prostate, that partial retention of urine follows the removal of the lithotomy tube, and requires the frequent introduction of a flexible catheter through the wound; and with this catheter, in the suspicious cases of which I am speaking, the grating of it against small pieces of stone may be felt, even when the patient has made no complaint of pain. Should a fuller examination prove the presence of a piece of stone, the patient may be placed on his left side, and the bladder well washed out; then, the exact position of the piece of stone being ascertained, it can generally be picked out by long slender forceps, or by one of the numerous instruments contrived for removing small stones without breaking them. In this way, the bladder may be wholly cleared, and the patient will be safe from recurrence of stone. It is quite unlikely that any but small pieces or small stones will have been left behind; if, unfortunately, a piece too large to come away in the manner described be present, it would be right to administer ether, tie the patient up again, dilate the wound, and use such forceps as may be necessary. This proceeding, however, is almost equal to another lithotomy operation, and I have never had recourse to it, but have preferred to let the patient recover, and then remove the remaining stone by lithotrity. Thus, many years ago, I removed by median lithotomy eight or ten small round stones from a gentleman, aged 61. Lithotrity might easily have been adopted, but he was resolute for lithotomy. He was a large fat man, and I could barely reach the bladder through the small median wound. Finding these small stones, I used every possible means to clear them all out of the bladder, syringing repeatedly, and searching with sound and scoop. Two experienced lithotomists who were present examined, but could not reach the bladder. As recovery proceeded, in about ten days, he began to complain of the old symptoms of bladder irritability; and a horrible suspicion came over me that I must have left one or two calculi in the bladder, notwithstanding all the precautions taken. I was young; this was my seventeenth case of lithotomy; the patient was a man of rank and high position, and well known to everybody in the district. He had been advised to go to London for treatment; and now, as he had put his faith in me, I felt that his recovery and my credit were painfully at stake. With a sound, a stone was detected. A day or two afterwards, Mr. Clover administered ether; an unfenestrated lithotrite caught the stone at once, and, feeling sure that it was small, like the others, I tried to extract without breaking it; it passed easily to within a few inches of the meatus; then the instrument was screwed home, the stone was all removed, and he recovered at once. I mention this case in some detail, that it may be a lesson to those who have yet to acquire experience.

Various Symptoms following Lithotomy.—There are some morbid conditions which occasionally follow lithotomy which deserve a brief notice. It has repeatedly occurred to me to witness alarming symptoms of cardiac disturbance, syncope, or angina, coming on suddenly after lithotomy, when the patient appeared to be progressing favourably. These symptoms have generally been observed in elderly men, who probably had some degree of fatty or other degeneration of the heart's structure, but who had, nevertheless, surmounted the shock and excitement of a great operation and an anæsthetic combined. These attacks seemed to threaten life, and, in one case, did prove fatal. They may not be restricted to the operation for stone; but I have seen them so often after it, that I have been obliged to think that there was something more than mere coincidence in their association.

Hiccup occurring after lithotomy is generally a grave symptom, especially if it be accompanied with abdominal distension and fever, pointing to peritonitis or pelvic cellulitis ; but it sometimes occurs as a very troublesome but not a dangerous symptom, lasting, perhaps, for two or three weeks. In one patient—an enormous man—it endured for fully three weeks, during which time he had at first vomiting, but no fever, and no signs of abdominal mischief. Gregory's powder, as an aperient, and chlorodyne, seemed to afford most relief, and he gradually recovered. Humphry mentions the case of a fat man who suffered from hiccup both before and after the operation ; it subsided in a few days, during which the progress towards recovery was favourable. Then he committed some dietetic excess ; the flatulence and hiccup returned, with collapse and speedy death. No abdominal or pelvic lesion appeared at the *post mortem* examination. This form of hiccup probably is due to intestinal disorder, and I only allude to it to show that it is not always a dangerous or formidable symptom.

Another condition which has been occasionally noticed is the fœtid or fæcal odour of the urine after lithotomy, to such an extent, that the person of the patient and the room even were almost unbearable. In one case, the wound had been plugged on account of hæmorrhage ; there was no difficulty in preventing its escape externally, but it evidently infiltrated the tissues around the bladder, and a tender spot was felt and a yellow stain was seen in the skin above the groin. The man was feverish and low ; and ten days after the operation the urine became horribly offensive, and continued so for several days, until an abscess discharged itself through the wound, when by degrees the urine lost the fœtid smell, and he recovered. In another case, there was no fever and no evident abscess, but simply stubborn constipation. On the second day, the urine was noticed to be peculiarly fœtid—almost fæcal—in odour ; there was flatulent distension, but no serious illness. Still, it was noticed that a week after the operation the urine contained a good deal of pus, and I cannot doubt that there was some small purulent collection near the bowel which allowed a diffusion of bowel-gas, just as we sometimes see in common abscesses near the rectum. This fæcal smell of the urine after lithotomy should, therefore, beget the suspicion of, and cause a strict search for, abscess near the base of the bladder.

Another symptom which I have occasionally noticed to accompany —I will not say to depend on—stone, both before and after operation, either lithotomy or lithotrity, is the secretion of a large amount of non-albuminous urine, almost amounting to diabetes insipidus. In the case of a boy, aged 13, it followed scarlet fever, and amounted to five or six pints daily of pale, opalescent, non-albuminous urine, of low specific gravity. A large stone, weighing six ounces, was removed ; but the patient died, after a long illness, of pelvic abscess. At the *post mortem* examination, the kidneys were found to be atrophied, and the calyces, pelves, and ureters greatly dilated. In other patients, generally elderly men, recovery took place ; but I have always felt distrust of such cases, and have been at a loss to explain and account for the condition. True diabetes is occasionally associated with stone ; and it would appear, when it exists in a mild and chronic form, not much to prejudice the recovery after operation. When, however, the disease is present in its more serious and aggravated form, the danger of lithotomy or any other severe operation cannot but be greatly increased. One such case has occurred to me : that of an eminent and well-known physician, whose constitution and health were utterly broken by confirmed diabetes. He was pale, anæmic, and emaciated. A lithic stone of moderate size had to be removed ; and there seemed good reasons, in addition to his own strong wish, for preferring lithotomy. The operation was quick and easy ; but the blood was so watery, and so deficient, apparently, in fibrine, that a light plug was required to stop the oozing. Death took place on the 10th day from exhaustion. The *post mortem* examination showed that the urinary organs were all healthy and uninflamed, and that the apparent cause of the diabetes was a tumour connected with the dura mater, which pressed on, and deeply indented, the surface of the brain. It may be added that, during life, the patient never had headache, or any cerebral symptoms whatever. Such a case, in a patient with such a frail state of health, would undoubtedly, at the present time, be treated by litholapaxy.

One other symptom may be mentioned, because, in one case, it misled me, and might mislead others. A man, aged 66, had two full-sized stones removed by lithotomy ; there was troublesome bleeding, which was arrested by the air-tampon. For some days, a good deal of mucus was observed on each draw-sheet, and it was supposed that this was the product of cystitis. On the fourth day, while I was trying to remove the tampon, I observed a quantity of glairy mucus coming from the rectum ; quite two or three ounces bubbled out in a few minutes, and more followed ; it was white, like jelly, and odourless, and soon ceased after the removal of the tampon which, I apprehend, had caused the secretion by undue pressure on the coats of the bowel.

The causes of death after lithotomy are especially deserving of attention, because they may point out some error in the diagnosis of the case, in the operation, or in the treatment after it. How often has it occurred to me to confess, at the *post mortem* examination, that, had I known or suspected beforehand this or that morbid condition, I would have done differently, or not have operated at all. I can scarcely call to mind having declined to operate in more than two or three cases ; several were done under circumstances which almost precluded hope of recovery, but in obedience to the pressing desire of the suffering patient to be relieved of the stone at all hazard. Looking through my note-books, I find that the black list is a long one, namely, 29 deaths out of 169 operations ; about 1 in 6, or 17 per cent. Of the 29 deaths, 13 cases were aged from 60 to 70, and 10 were over 70. The average age of the whole was 60, and the average weight of stone was 2 ounces. In a man, aged 80, the stone weighed 6½ ounces ; in a boy, aged 13, it was 6 ounces ; and in a middle-aged adult, it was over 4 ounces. The considerable size of the stones, the great age of the patients, and the serious complications existing in many of the cases, may explain—I was going to say, extenuate—the heavy mortality ; and it may be further mentioned that the most favourable cases were reserved for lithotrity. In like manner, Sir H. Thompson, after deducting a very large number of cases of lithotrity, gives his mortality after lithotomy at 35 per cent. It is a curious coincidence, that, although my cases of lithotomy have largely consisted of old men with renal, prostatic, and other complicating diseases, the first fatal case was in an infant a year and a half old, who died of convulsions the day after the operation.

The following table shows the age, date, and cause of each of the twenty-nine deaths, from which it will be seen that phlebitis and pyæmia account for nearly a quarter of the whole ; and with reference to this, I may say that, for some years, our hospital suffered greatly from pyæmia, and that all efforts to abate it were without avail, until the whole system of nursing was changed, and the entire charge was given over to a skilled nurse, a lady of great force of character and untiring energy. A revolution in management was established ; pyæmia almost disappeared as if by magic ; a new hospital has since been built, but both in the old and in the new, from the time mentioned, now nearly ten years, I have not had to register a death from pyæmia; and we have almost ceased to think of it. In ten cases, there was marked disease of the kidneys. This is by far the most formidable obstacle to successful lithotomy ; it is a complication of stone which no amount of experience seems to enable one to diagnose with accuracy; no symptoms, marked and prominent, and constant enough, exist to indicate it. The condition of the urine throws but slight light on it; the presence of albumen, pus, or mucus, cannot be relied on, for the state of the bladder, with some concurrent cystitis, is probably there to impair this means of diagnosis. The aspect of the patient—pallor, flabbiness, and debility stamped on it; the nature of the stone—phosphatic, with chronic cystitis and vesical atony; these

Causes of Death after Lithotomy.

No.	Age.	Weight of Stone.	Remarks.
1	1½	—	Convulsions on second day; no *post mortem* examination; median operation.
2	66	—	Median operation; prostatic retention; catheter used; death fifth day; bladder thin and dilated; kidneys diseased; ureters large; pyæmia (?)
3	66	℥iss	Median; died sixth day; rigors violent; ague (?); bladder sacculated, one very large; kidneys healthy; prostate very large.
4	64	ʒxss	Median; nearly recovered; died of acute peritonitis three months after operation; abscess behind pubes, opening into bladder; kidneys diseased; stone in right one; prostate large.
5	62	ʒxi	Median; death fifteenth day; old hemiplegia, diphtheria, pyæmia visceral abscesses; contracted kidney.
6	52	ʒvij	Median; death eleventh day; phlebitis and pyæmia.
7	60	℥iv	Lateral; hæmorrhage and shock; death second day.
8	68	ʒv	Lateral; death seventh day; pyæmia, hepatic abscess; opium eater; great enlargement of prostate; chronic retention.
9	66	ʒiij	Median; death in ten weeks from exhaustion and kidney disease, pyelitis, chronic prostatic retention.
10	64	ʒiij	Median; death from pyæmia fourteenth day; rigors and fever; enlarged spleen.
11	70	ʒx	Lateral; death tenth day: exhaustion, fatty liver, and kidneys.
12	60	ʒiiss	Median; death fourteenth day; pyæmia, phlebitis.
13	11	ʒiij	Lateral; death tenth day; pyæmia, visceral abscesses.
14	73	ʒix	Lateral; death second day; shock and hæmorrhage.
15	71	ʒxiij	Lateral; death fifth day; kidneys diseased, hæmorrhage.
16	70	℥iij	Lateral; death eleventh day; rigors, kidneys diseased, ureters dilated; bladder contracted, and sacculated encysted stone.
17	64	ʒv	Median; recovered, and wound healed, then phlebitis and pyæmia.
18	34	—	Lateral; death seventeenth day; pyæmia.
19	63	ʒiv	Lateral; death eleventh day; diabetes and exhaustion; tumours of dura mater; no other organic disease.
20	65	—	Lateral; death eighteenth day; cause not clear; no *post mortem* examination; would not eat; probably kidney-disease.
21	80	℥viss	Lateral; exhaustion; death fourth day.
22	76	℥ij	Lateral; three stones; great enlargement of prostate; catheter used for years; death fifth day; suppression of urine.
23	13	℥vj	Lateral; death from pelvic abscess three months after operation; kidneys atrophied; ureters dilated and tortuous; calyces and pelves dilated; had diabetes insipidus.
24	73	ʒvi	Lateral; death in two months from lung disease; no *post mortem* examination.
25	57	℥iv ʒj	Lateral; death in a month; secondary hæmorrhage; no *post mortem* examination.
26	61	—	Female; death seventh day; peritonitis, encysted stone, sacculated bladder.
27	70	ʒxiij	Suprapubic operation; death fourth day; suppression of urine, kidneys diseased, ureters dilated, injury to rectum.
28	70	ʒv	Lateral; death fifth day; enormous man; kidneys diseased, pulmonary congestion; spleen 8 ounces.
29	72	—	Death eighth day; secondary hæmorrhage; feeble man; old retention; pyelitis; stone in kidney; enlarged prostate.

conditions may well produce suspicions of kidney-disease; but, on the other hand, not a few cases have occurred of hard lithic stones in ruddy-faced farm-labourers, in which death from renal disease followed lithotomy, and in which it was wholly unsuspected. The form of kidney-disease which most frequently causes death after lithotomy is nephro-pyelitis, in one or other of its varieties; either acute interstitial nephritis, with scattered abscesses, or more chronic pyelitis, with dilated suppurating pelves and ureters; this form is that in which the pale and anæmic physiognomy alluded to is seen. Another form is that in which the kidney is either in a state of atrophy and contraction, or where it is enlarged and coarse and soft in structure; and this form is that in which there is often, but not always, a florid healthy aspect.

I have only seen two instances of stone combined with Bright's disease—that is, with albuminous urine of low density, and some degree of anasarca and anæmia. Both these cases recovered from the operation, but died some months after of the more serious malady. In two, probably three, cases of kidney-disease, suppression of urine was the proximate cause of death.

Infiltration of urine, pelvic abscess, and peritonitis, separately or in combination, were formerly considered to be the most frequent cause of death after lithotomy. Sir W. Fergusson, however, denied this, and went almost so far as to say that urinary infiltration never occurred. The truth, as usual, I believe lies between these two extreme views. In my own cases, I have never seen pure urinary extravasation leading to sloughy cellular tissue around the bladder; but several cases have occurred of pelvic abscess and peritonitis, which have been attributed to slight infiltration of urine or to decomposition of extravasated blood; and peritonitis also of a purely septic or pyæmic origin has been observed.

Exhaustion due to shock and hæmorrhage combined, to diabetes and anæmia, to chronic pulmonary disease, and to previous hemiplegia, has proved fatal occasionally. Lastly, I have noticed in three fatal cases great enlargement of the spleen; this has occurred in very florid elderly men, with blue feet and legs, and universal congestion; this condition and class of patients would now lead me to prefer lithotrity in all practicable cases, and, where it is not practicable, to adopt the suprapubic operation.

Recurrence of stone after lithotomy is a matter of much interest, because of its bearing on the choice of operation, on the one hand, between perineal and suprapubic lithotomy, and on the other hand, between lithotrity and lithotomy. If it can be proved that recurrence is far more frequent after lithotrity than after cutting, this fact should decide one to adopt lithotomy—and in my own practice it not unfrequently has done so. On this matter of recurrence, the records of the Norwich Hospital afford valuable, if not quite conclusive, evidence. A short time ago, Mr. Donald Day, our late house-surgeon, very much at my suggestion, carefully examined these records, and compared them with the stones in the museum; and he has given the results of his inquiry very clearly and succinctly in the BRITISH MEDICAL JOURNAL (February 13th, 1886). He ascertained that, out of 884 individuals (males), forty-five were cut a second time, an average of about one in twenty, or 5 per cent., and five were cut a third time. Of course, this does not give the whole number of recurrences, but only the number of repeated operations of lithotomy. Doubtless there were some, especially in the pre-anæsthetic period, who declined to submit to further treatment, or went elsewhere; but, as the same motives would exist in recurrence after lithotrity, the figures are good for comparison.

There are two chief causes which lead to recurrence of stone; namely, 1, the descent of a fresh calculus from the kidney; and 2, the leaving of stone or fragments of stone undetected at the first operation. Of the fifty instances of repeated operation mentioned, rather more than one-third were due to an entirely fresh stone descending from the kidney. Uric acid or urates was the composition of nearly all of them; the second formation was generally the same, and the interval between the operations was frequently long, giving an average of five to six years. The second class, or those in which stones or fragments of stone were left behind, include nearly two-thirds of the whole, and shows the enormous importance, when a stone breaks in extraction or there are multiple stones, of making the most careful search, and the most resolute efforts to effect a thorough clearance of the bladder. In these cases the second stone is often composed of phosphates, or mixed phosphates and urates, and the interval between the operations is much shorter than in the first class. Some few of these cases should perhaps, as Mr. Day suggests, be placed in a separate group; cases in which the bladder has been entirely cleared at the first operation, but in which soft porous masses of white phosphates have subsequently gathered, and have been caused by enduring cystitis, by fistula, or more likely by the incrustation of the deep portion of the wound by phosphatic deposit in weakly patients after a severe operation. This sabulous coating comes away from the wound, and the latter cleans as the patient gains strength; but occasionally some of it at the neck of the bladder remains, and forms a nucleus for fresh phosphatic stone in a few months. Cystitis will not lead to deposit of phosphates, unless some ulcerated or abraded surface, or a clot of blood or concrete mucus, be present, in which case rapid aggregation of soft stone will take place. I will, however, again refer to this matter, in speaking of recurrence after lithotrity.

Stone in the Female.—It must be in the experience of all surgeons, how seldom the sound detects a stone in the female bladder, although the symptoms are present even in vivid intensity. Vesical irritability and cystitis, not dependent on stone, are probably as frequent in women as in men, and are fully as difficult to remedy. They depend on somewhat the same causes; namely, on cold, on tuberculosis, on neglected gonorrhœa, and, as special causes, from pressure on the bladder when distended during labour, or from uterine displacements and versions. When calculus is present, the symptoms are nearly the same as in men; if the stone be small and freely movable, the suffering is great; if it be large and heavy, and weigh down the floor of the bladder into the vaginal canal, so that by this prolapsus it becomes fixed, the suffering may be mitigated and even masked. Paget, of Leicester, reported a case of stone in a woman, which weighed 27 ounces; it was prolapsed between the labia pudendi, and caused so little inconvenience, that the woman never consulted a medical man, and did hard work. In some cases of this kind, nature accomplishes a kind of cure, by a process of inflammation and ulceration of the contiguous mucous membrane and spontaneous escape of the stone. This large stone, weighing over 6 ounces, passed from a woman after a process of prolapsus and ulceration. I once assisted a surgeon to remove a full-sized calculus, which had become partially prolapsed, and had been mistaken for a procidentia uteri.

Dr. Emmet speaks of stone in the female following the operation for vesico-vaginal fistula, and being due either to the ends of the metallic suture having been left, and escaping into the bladder, or to faulty adjustment of the edges of the wound, by which a projecting part or some denuded surface is left, on which phosphatic deposit takes place. In 1,125 operations for stone, at the Norwich Hospital, there have been only 50 in the female, a proportion of about 1 to 20 in the male. In my own experience of 300, I have only met with six in the female.

The earlier hospital cases were, I believe, done by cystotomy; but, for many years, dilatation and extraction, with occasionally a slight incision, has been the plan adopted; lithotrity never, suprapubic lithotomy once, and vaginal lithotomy once or twice only. I say only once or twice, because I have heard of no others, and Mr. Crosse makes no mention of any; but it is just possible that, in the very earliest years of the hospital, that method may have been practised, because Benjamin Gooch, who, if not the originator of it, was one of the first to adopt it, lived at Norwich, and was the chief founder of the hospital, in 1771. He thus describes the operation (*Cases and Remarks in Surgery*, vol. ii, p. 178): "After putting her in the usual position for the operation, I intended to have proceeded in the common manner, by dilating the urethra, and making an incision, as should be found necessary, to facilitate the extraction of the stone; but finding, with my finger, that it lay very favourably to be cut upon, through the vagina uteri, now considerably dilated, I altered my original design, and, with the approbation of two experienced practitioners, cut directly upon it, and extracted it with very little pain to the patient and trouble to myself, compared with what a stone of between 3 and 4 ounces weight must have unavoidably occasioned, by performing the operation in the common method. The symptoms after the operation were most gentle, and she was perfectly cured in three weeks, without any defect remaining in the retentive faculty." He refers, also, to two other similar cases by other surgeons, he being present. Thus, then, vaginal lithotomy, which is generally regarded as a modern operation, due chiefly to Marion Sims and Aveling, and which Emmet describes as nearly the only fitting way by which to remove stone in the female, is at least a century and a half old. Good as the operation is, however, for the removal of stones of about the size of a hen's egg, it is not, I think, adapted for the removal of very large calculi. The distance between the internal orifice of the urethra and the os uteri is limited, and, although an aperture, say of an inch, or an inch and a half in length, would dilate a good deal, there would not be room enough to extract a very large stone with safety. Lately, one of my colleagues removed a stone weighing 7 ounces, by vaginal lithotomy. It was an operation of some difficulty, and the wound was extended unavoidably, by laceration, nearly up to the external orifice of the urethra; and there was, necessarily, a good deal of bruising of the soft parts. Emmet describes a case in which he was unable to extract a stone through the vaginal incision, until he had diminished its bulk by inserting two fingers behind the stone, and chipping off portions of the outer layers, by cutting-pliers or scissors. Moreover, although, as Gooch describes, and as we see in the male, a wound in the bladder will generally heal of itself, it is always thought necessary, in vaginal operations, to close it accurately by sutures; and, if there have been much bruising of the edges during extraction of the stone, union may fail, and this may entail several operations to cure the fistula, and this is, besides, an operation of nicety, requiring an experienced hand. On the whole, it is probable that, for stones of 3 ounces and upwards, the high operation, done by the modern method, will come to supplant the vaginal incision. While I say this, however, it must be borne in mind that, while there is no reason to expect a less mortality in women than in men, from the high operation, we know that all other operations for the removal of stone in women are far less fatal than in men; so that, unless the improved method of the suprapubic operation shall prove to be more successful than the old, there can be no such supplanting as I have mentioned.

In female children, in whom the vagina and urethra are small and undeveloped, the bladder high in the pelvis, and the tendency to urinary infiltration slight, the suprapubic operation is, undoubtedly, the best for all cases, except those in which the stone is very small; and, for these, litholapaxy, according to recent Indian experience, is well adapted.

Having had but small personal experience of stone in the female, I desire to speak with diffidence as to the merits of the various modes of treatment; but I may say that the conclusions to which I have come are, that, for stones of small size—for instance, not larger than a filbert—in the adult female, rapid dilatation of the urethra, and careful extraction, is the best method; that litholapaxy is, probably, the best operation for those which are larger— say, from half an ounce to an ounce, or even more; that, for those which are about the size of a hen's egg, vaginal lithotomy is well adapted, and the high operation for all above that size. Further experience, however, may somewhat modify these conclusions.

Suprapubic Lithotomy.—Suprapubic lithotomy in its revived and modern method requires careful notice and examination. Its past history has been chequered and uncertain, and the results obtained have not been satisfactory, but its future is full of hope and promise. At the present time, surgeons are divided in opinion as to its methods, its capabilities, and its merits.

History repeats itself. In this very year, several cases have occurred in which stones of great magnitude have been attacked by perineal lithotomy without success, and have been at once removed by the high operation. Precisely the same thing occurred to Peter Franco in the middle of the sixteenth century. He attempted to remove a large stone from a child's bladder by perineal section, failed, and was persuaded by the child's parents and others to attempt its extraction by abdominal section. He succeeded; the child recovered, and this was the actual beginning of the history of suprapubic lithotomy. So doubtful, however, was Franco as to the wisdom of the proceeding that was to perpetuate his name, that he warned others against attempting it. It is needless here to trace its history or to relate fully how it was at first greatly extolled by Rosset; how it fell into neglect until it was revived in 1720 by I. Douglas and Cheselden; how at that time, influenced, no doubt, by Cheselden's success, the surgeons of St. Thomas's and St. Bartholomew's hospitals took it up; how, in consequence of fatal accidents, such as opening the peritoneal cavity, bursting of the bladder by over-distension, etc., it soon became discredited, while the lateral operation practised and perfected by Cheselden gave it its *coup-de-grâce*, in this country at all events, as a general operation for stone. Abroad, it could still reckon its advocates; Frère Côme, who, in 1770, modified it by omitting the injection of the bladder and introducing the *sonde-à-dard;* Souberbeille, in 1818, who nearly followed Côme's method; Valette, of Lyons, who recommended that the bladder should be opened by caustic at a second operation; and many others. In England, for the last 150 years, it has been adopted only in cases in which the stone is very large; and even in those, lateral lithotomy has generally been preferred. Thus we read of stones of 10, 12, or even 15 ounces having been successfully removed through the perinæum, and it is not a little singular that in the Norwich Hospital the high operation has, so far as I know, never been done until two years ago by myself. Still, it must be admitted that perineal lithotomy has been unsatisfactory in its results when applied to stones above a moderate size; it is difficult to do; laceration and rough instrumentation are unavoidable, and the mortality has been great, probably not less than 35 to 45 per cent. when the stone has weighed over 2 ounces. I have long felt this difficulty, and have often, during the last twenty years, asked myself, and those friends who have much practice in lithotomy, what is the best way of removing a stone of 3 or 4 ounces, and whether the high operation did not call for fresh examination, considering the advances of abdominal surgery and the antiseptic method? In 1878, a discussion took place at the Clinical Society on a paper by Mr. Hutchinson on suprapubic lithotomy. The general tone of the meeting was rather deprecatory of than favourable to the operation. Its difficulties and disadvantages were prominently spoken of, and I mention this to show the contrast between the tone then and that confident, buoyant, and laudatory account which was recently given of it at the Royal Medical and Chirurgical Society, and we may now consider the reason for this difference.

At the Clinical Society, in 1878, Mr. Heath said that "he had recently seen a pamphlet in which it was said that distending the rectum did good in making the bladder project above the pubes." This was the paper by Dr. Garson, then just published in the *Edinburgh Medical Journal*, which, beyond all doubt, laid the foundation for, and acted as the pioneer to, the re-examination and revival of suprapubic lithotomy. The facts therein related, and the effects of fully distending the rectum in facilitating the steps of the operation so plainly stated by Garson, attracted little or no notice from British surgeons; but the paper, having been communicated to a Medical Congress at Berlin, in 1878, was not neglected there. Professor Petersen, of Kiel, took the subject up, and, having first repeated Garson's experiments on the dead body, applied his knowledge to the living, and operated on several cases of stone successfully. He has been quickly followed by many in Germany, Russia, and France; and the papers in various continental journals, and at medical congresses, one so lately as April last in Berlin, are too numerous even to mention. In England, we have been somewhat slow to take up the inquiry. Sir H. Thompson alluded to it from this chair two years ago, and soon afterwards performed his first operation. Having followed that by several other cases, he has recently, as we all know, published his views in an excellent essay. Having started in the inquiry, there is no fear of our lagging behind our continental brethren. Rather I should say there is some fear that our enthusiasm should outstrip discretion, that the operation should be applied to all kinds of cases, fit and unfit, and to stones of all sizes, and to persons of both sexes and of all ages, and not only for stone in the bladder, but for tumours of all kinds, and even for stricture of the urethra. While this keen interest in the subject is going on, let us consider (1) the principles on which the modern operation is based, and (2) the advantages and disadvantages of it as compared with other methods. The principle consists in the fact that moderate distension of the bladder and rectum raises the bladder well above the pubes, brings every part of it well within the reach of the finger, and elevates the prevesical fold of the peritoneum considerably above the symphysis pubis. All this is, I think, fully proved by numerous experiments, both in England and abroad; but it may be worth while to examine them somewhat in detail.

The position of the peritoneum lining the anterior wall of the abdomen is, the bladder being empty, that it passes down to the symphysis pubis, and is then reflected over the posterior wall of the bladder, so that an incision in the median line, close above the pubes, would inevitably come directly upon it.

Distension of the bladder only, the rectum being empty, will generally raise this fold of peritoneum from one and a half to two inches above the pubes. Pirogoff, Braune, Garson, Bouley, indeed all, or almost all, observers agree that full distension of the bladder will not only have this effect, but that the effect will be greater in fat than in thin people. There are, however, many exceptions to this rule. The capacity of the bladder varies greatly. Langenbuch says that, by extreme injection, room enough may be obtained above the pubes without filling the rectum. Fehleisen, on the other hand, holds that, the rectum being empty, distension of the bladder has very little effect in raising the fold of peritoneum; that, with twenty ounces in it, the fold will be only three-quarters of an inch above the pubes; and he assigns as a reason for this, that the bladder, as it fills, presses backwards and downwards rather than upwards, filling the hollow of the sacrum. Much caution is required in this proceeding in the living, especially when there is a stone. In old people, there may, and probably will, be sacculi; and the walls of these, being thin and unsupported by muscular fibres, might yield to the distending force. Sometimes, too, the bladder is thick and contracted, and will scarcely distend at all; while M. Polaillon believes that, in one case, the fluid, instead of distending the bladder, found its way into the enlarged ureters, and distended them, instead of, or as well as, the bladder. All things considered, therefore, it may be said that, in operating by the suprapubic method in the adult, we ought not to depend solely on vesical distension.

Distension of the rectum only, the bladder being empty, raises the floor of the latter very considerably; but, according to my observations, it has but little effect on the upper part of it, or on the fold of peritoneum. Whoever will distend the rectum with twelve to fifteen ounces of fluid in a rubber bag, and then examine the parts, will see that the distended bowel fills the whole hollow of the sacrum, where it is bound down by the cellular connections of the gut to the walls of the pelvis; that it elongates the membranous and prostatic urethra, and elevates the vesical orifice and the whole lower fundus of the bladder to such an extent that the finger, passed through an aperture above the pubic symphysis, can reach every part of it easily, and if, while the finger is doing this, the fluid in the rectal bag be allowed to escape, the floor of the bladder will sink almost out of reach.

When both bladder and rectum are moderately filled, the former, not being able to occupy the lower half of the pelvis, is forced upwards and forwards against the abdominal wall, and carries up the prevesical fold of peritoneum from one and a half to two and a half inches, according to the amount of fluid injected into the two cavities. It is needless to recount the actual measurements given by various observers; they have not all been taken precisely in the same way, and they are approximate rather than exact; still, they are tolerably uniform, and liable only to occasional exceptions. It is probable that, in the living body, with its animal heat and less solidified condition of adipose tissue, the separation and elevation of the fold of peritoneum would be easier and more considerable than in the dead body; this, however, cannot be demonstrated. Mr. Barwell, in a carefully conducted series of experiments, has found that distension of the rectum, in addition to that of the bladder, does not sensibly increase the raising of the prevesical fold of peritoneum; he maintains that this is almost entirely effected by distending the bladder only; and he, therefore, in his operations, dispenses with the rectal bag. His investigations, however, were made with the abdomen fully opened, and this may, as Dr. Garson suggested, account for the different results which he has obtained. My own experiments would rather tend to confirm those of Mr. Barwell; but I should still strongly advocate the use of the rectal bag, not only for its influence, slight though it be, in helping to carry the peritoneum out of danger, but chiefly because it brings the floor of the bladder within easy reach of the finger.

As to the method of operating, I have but little to say; that adopted by Sir H. Thompson is probably the best, namely, to use the knife as little as possible, and the finger-nail, or some blunt instrument, as much as possible as the bladder is approached; push up the peritoneum if it be seen; fix the bladder with a hook before opening it; use no suture for the bladder-wall after removal of the stone, and only one or two for the upper part of the external wound. Some surgeons stitch up the bladder accurately, and introduce and retain either a full-sized catheter through the urethra, or a drainage-tube through the perinæum. These means, however, will seldom prevent the urine from escaping by the upper bladder-wound; the catheter or drainage-tube may become blocked, or may slip a little; urine gathers in the bladder, and immediately makes its way upwards between the sutures. There can, I think, be little doubt that the safest course is to leave both the external and the bladder-wound freely open; all fluids—blood-serum, and urine—can then readily escape, and the risk of infiltration of urine is reduced to a minimum. A good-sized rubber, or silk-elastic tube may be used to facilitate drainage for two or three days. I have made this tube of sufficient length to reach into a basin placed by the bedside, and have fastened it to one edge of the outer wound to prevent its being accidentally dragged out; by this means the patient is kept comparatively dry and comfortable; he lies first on one side and then on the other, the nurse carefully carrying the tube from side to side with him. There are two kinds of rectal bag in use: one, a simple pear-shaped rubber bottle, which will dilate to any size; the other has a layer of linen in its walls, and will only hold a certain quantity; the former, when empty and rolled up, is rather the easier to introduce, but it should be filled from a graduated glass vessel, so that the exact quantity desired, say twelve or fourteen ounces, may be introduced. These, and other details of the operation, however, may come to be modified as experience increases.

In females, in whose bladder a full quantity of water cannot easily be retained, Sir H. Thompson has recommended the use of a hollow sound, with a slit at the end, fitted by a stylet; this is made to push against the front wall of the bladder, close behind the pubes, where it is felt in the wound; the stylet is withdrawn, the slit is struck by the scalpel, and the bladder opened. It is doubtful whether this manœuvre will, in practice, be found necessary. I have found that, in the dead body, the pressure upwards of the rectal bag is sufficient to close the vesical orifice, and retain a fair quantity of fluid in the bladder; or the finger of an assistant, pressing the urethra against the pubic arch, would readily retain the water until the bladder is opened from above.

In children, even when the bladder and rectum are empty, the peritoneal fold is generally from half an inch to an inch above the pubes; but, with a distended bladder, with three or four ounces even, it will be carried well up out of harm's way. No distension of the rectum is required, but the finger of an assistant may be of use in helping to raise the stone and the floor of the bladder.

LECTURE III.

Advantages of Suprapubic Lithotomy.—Disadvantages.—Application. Lithotrity.—Operation.—Causes of Death.—Litholapaxy in Children —in Adults—in the Aged.—Recurrence of Stone after Lithotrity.— Choice of Operation.—Conclusion.

Advantages of the Suprapubic Operation.—These are considerable. 1. It is easier of performance than perineal lithotomy, or, in many cases, than litholopaxy; and this is a point of no small importance, especially to those who are not frequently called on to operate for stone. The high operation, as formerly practised, was by no means free from difficulties, due chiefly to the greater proximity of the peritoneum, to the sinking of the bladder, when opened, into the depths of the pelvis, and to the consequent inability to reach it. Now, with the bladder brought well into the abdominal cavity, and retained there by the rectal bag, it needs only common skill and prudence to operate. In this, however, as in most other operations, much facility will be acquired by previously practising it on the dead body. 2. By it, stones of the greatest magnitude may be removed. Dr. Cayley, in India, Dr. Morison, of Hartlepool, and Mr. Rivington, have removed stones weighing 25 and 23 ounces. These could never have been extracted through the perinæum, and it is not to be supposed that their removal by the high operation was easy. Mr. Rivington found it necessary to break up the stone with a chisel and mallet, and withdraw it piecemeal, and M. Guyon mentions a case in which he had to do the same. Both these cases, however, recovered from the operation. Dr. Morison found it impossible to extract the stone with any lithotomy-forceps, but managed cleverly to deliver it—if I may use the term—with a pair of small midwifery-forceps. 3. Infiltration of urine, it is said, should not occur after the high operation. Anatomically considered, the loose cellulo-adipose tissue covering the bladder would, I think, induce one to fear the permeation of it with urine and blood, and consequent mischief; and it must be admitted that some deaths from this cause have already been reported, while, by the old method of operating, fatal infiltration was by no means uncommon. 4. Freedom from troublesome bleeding ought to be, and probably will be, found to be greater than after perineal lithotomy. There are no arteries lying in the knife's course, but there are some considerable veins coursing over the bladder, and the bladder-wall itself is vascular; notably, there are two veins which I have repeatedly observed (best in thin people) running parallel with each other from the apex down the front of the bladder, to join the plexus around the prostate; the line of incision would usually run between, but close to them, and they might, without care, be easily wounded. In several cases recently reported, sharp bleeding has occurred, checked in one case by a timely ligature, and in another by a firm plug and compress; so that on this point, as on others, we must suspend judgment for the present. 5. The suprapubic is certainly less liable than the lateral operation to various subsequent drawbacks, such as fistula, wound of the rectum, impotence, etc. 6. There should be but little risk of leaving stones or fragments of stone undetected. In certain cases of lateral lithotomy, where the prostate is enlarged, and the bladder not within reach of the finger, this is a very real risk; but, in the *sectio alta*, the finger will almost always be able to explore every part of the cavity; and, as less force is required to extract the stone, so there will be less liability to break it.

The risks and disadvantages of the operation are, happily, not great. The chief one is the possible opening of the peritoneal cavity, leading to peritonitis from urinary extravasation, or to hernial protrusion of the intestines. With the present plan of operating, this danger is remote, but it has occurred. It is not easier to recognise the outside of the serous membrane in this operation, than it is in ovariotomy, or in dividing the coverings of a hernia; should it be opened, it may be well to consider what is the best course to adopt. M. Polaillon, in one case, closed the wound, and postponed the further steps of the operation. Dr. Tremaine, of Buffalo, having removed the stone and partially closed the wound, was called to the patient in less than half an hour; and found that, under the stress of vomiting, a quantity of small intestine had escaped through the wound. He at once clipped the sutures, returned the bowel, and stitched the anterior wall of the bladder to the abdominal wound, so as effectually to close the aperture in the peritoneum, and the patient made a good recovery. Some surgeons contend that the contact with, or entrance of, healthy acid urine into the peritoneal cavity, would not necessarily produce peritonitis; but I know of no evidence to justify this opinion, and, moreover, the urine in stone cases is seldom quite healthy. The safest course, however disappointing, would probably be, if the accident were immediately discovered, to close the wound, and postpone further proceedings for a short time. Rupture of the bladder from over-distension is not likely to occur, if the injection of fluid be arrested as soon as real resistance is felt. Violent straining of the bladder and rectum, with extreme rigidity of the abdominal muscles, are apt to come on, but they will subside in a short time. In the case, lately, of a girl whose bladder contained a stone, this straining, I found, came on before three ounces were injected, and the water was expelled with great force when the catheter slipped out. The quantity of fluid used varies with the retaining power of the bladder; in children, probably not more than a few ounces; and in old men, with atonic bladder, twelve to fifteen ounces, or more, may be introduced. Similarly, injury to the coats of the rectum will not happen in future, if the quantity of water introduced into the bag be limited to twelve or fourteen ounces. Petersen and Guyon speak of larger quantities; but a larger quantity is neither necessary nor safe. The only instance of this accident that I know of, occurred in my own practice, in the case of an old man, into whose rectum I injected, slowly and easily, nearly eighteen ounces; he died of kidney-disease and suppression of urine five days after the operation. All the surroundings of the bladder were healthy; but there was a rupture of the mucous membrane and of the circular muscular fibres of the rectum, to the extent of an inch, near the bladder. The report of published cases would seem to show that recovery is rather slower after suprapubic than after lateral lithotomy; the urine resumes its natural route more tardily, and the operation-wound takes a long time to heal; and this, not only after the removal of very large stones, but even when they have been small. This, however, will not deserve much consideration, if it can be shown that the cure is more certain and more complete than after other methods. It must be admitted that the suprapubic wound is unfavourably placed for thorough drainage of the bladder; it is at the least, instead of the most, depending part, as the patient rests on his back; and, to obviate this difficulty, it is well to place him on his side. Trendelenburg tried the prone position; but this evidently could not be long maintained, and did not answer.

Application.—The cases for which, and the limits within which, the suprapubic operation is applicable, cannot at present be confidently stated. All are agreed that it is to be preferred to other methods for very large stones; those, namely, which exceed the size of a hen's egg; but how, it may be asked, should a stone, which is just too large to be amenable to lithotrity, be dealt with? by perineal or by suprapubic lithotomy? Should the advantages claimed for the latter be made good (and there are strong grounds for the expectation), then the lateral method, however reluctant we may be to relinquish it, must yield the field to its newer rival.

It cannot be denied that lateral lithotomy has, in most hands, for stones weighing over 2 ounces, proved fatal in the proportion of 40 to 45 per cent. The record of the Norwich Hospital gives, for stones of 2 to 3 ounces, 54 cases with 20 deaths; of 3 to 4 ounces, 14 cases and 9 deaths; of 4 to 5 ounces, 9 cases with 3 deaths; of 5 to 6 ounces, 3 cases with 2 deaths; of 6 to 8 ounces, 2 cases with 1 death; total, 86 cases (males) of stones over 2 ounces with 39 deaths, being 1 in 2.20, or about 45 per cent. The death-roll of four of the large London hospitals for similar cases is, I believe, somewhat larger than this; whilst the mortality of the suprapubic operation for stones weighing over two ounces is, according to Dr. Dulles, somewhat less: namely, 62 cases with 22 deaths, or 1 in 2.8, being 35½ per cent. It would not be safe to put too much trust in these statistics; the conditions are not equal. The Norwich tables are fairly taken; they include all the cases, successful and unsuccessful alike, which have occurred in one institution, and it may be conceded that the large majority of them were done by fairly competent hands; but the suprapubic cases were gathered from all sources, and were done by many hands, competent and incompetent. They include those only which the various surgeons choose to publish, and we know how reluctant many are to put forward unsuccessful cases. This inference would, of course, tend to reduce the success of the suprapubic operation; on the other hand, we may confidently expect that, with our improved methods, with our increased knowledge of abdominal surgery, and with the partial use of antiseptic measures, the results obtained will be far better in the future than they have been in the past.

There is a class of cases for which the high operation will probably become more and more applicable; namely, the combination of stone with considerable enlargement of the prostate gland. Looking back at my own experience, I perceive that these cases constitute a very large proportion of the whole, and they furnish also a large proportion of the unsuccessful, incomplete, and fatal cases. They are more difficult to cope with than any other class; the bladder often cannot be reached; stones, or fragments of stone, are apt to be left behind; hæmorrhage is frequently serious, and is difficult to deal with; in short, a full-sized stone associated with a large prostate constitutes, as I have before said, the maximum of difficulty in lateral lithotomy. Those surgeons who, like Mr. Reginald Harrison, believe that it is good practice to try, not only to remove the stone, but also to cut away portions of the prostate gland, or to make incisions through obstructing parts of it, will still prefer the perineal route. For my part, with all respect for these views, I am disposed to treat the enlarged prostate with forbearance and respect, and to leave it absolutely untouched. The pain, cystitis, and misery which these patients endure, are due, not so much to the prostate, as to the added trouble of the stone; and, in my experience, the entire removal of the stone will, in almost all cases, place the patient in comparative comfort. The high operation in these cases would present no unusual difficulties; the bladder is usually large and dilatable, and the stone would be within easy reach. An awkwardly enlarged prostate not only impedes the lithotomist; it equally frustrates the lithotritist, and renders his efforts unsatisfactory, as I shall presently show; and so, should the high operation have anything like the success which is predicted for it, not only will it supplant the lateral operation in such cases, but I can conceive that it will sometimes take the place of lithotrity also.

In all cases, the stone is much more within reach by the high operation than by any other; therefore, if the stone be encysted, it will probably offer some decided advantages. The distance between the surface of the perinæum and the entrance to the bladder is always considerable; but, in many cases of encysted stone, the distance is increased by reason of hypertrophy of the prostate, and so the entrance to the enclosing cyst can seldom be got at with precision or safety, so as to extricate the stone; but, in the high operation, this would probably be more practicable.

In children (boys), the suprapubic operation has hitherto found its best success. The abdominal position of the bladder, the higher position of the anterior fold of the peritoneum, and the slight liability of children to urinary infiltration, are strong inducements to its adoption. On the other hand, lateral lithotomy is also very successful; still it is not always an operation free from difficulty, and occasionally it fails altogether, even in experienced hands. When the stone is of any considerable size, the high operation is preferable to the lateral; and, when the stone is quite small, lithotrity, even in young children, has much to recommend it; but, in the average run of cases of stone in the young, results alone can decide which method is the safer.[1]

Lithotrity.—In discussing the subject of lithotrity, we stand on much firmer ground than in speaking of suprapubic lithotomy. There are facts and experience in abundance, on which to ground a reliable judgment, although there are still some points of detail requiring further elucidation. Like the high operation, it has recently undergone a remarkable development, but this development has already stood the test of time and trial enough to justify its general adoption.

The history of Bigelow's brilliant innovation on the old method is too well known to need detailed notice. It is curious how near some of the earlier lithotritists approached it. Heurteloup certainly seized the true idea, but had not the instruments wherewith to carry it out. Sir Philip Crampton used suction to extract fragments of stone from

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[1] The rate of mortality of suprapubic lithotomy, since the introduction of Petersen's method in 1879, is, according to M. Garcin, of Strasbourg, 94 cases with 23 deaths, or 24 per cent.

Age.	Cases.	Ratio.	Percentage.
1 to 10	22	1 in 4.40	22.2
10 ,, 20	26	1 ,, 2.6	38.4
20 ,, 30	8	1 ,, 4	25
30 ,, 50	7	1 ,, 7	14.28
50 ,, 70	16	1 ,, 2.8	43.75
70 ,, 90	11	1 ,, 2.75	36

M. Tuffier, of Paris, gives more recent cases, including the above, namely, 120 operations, with a mortality of 27 per cent. (*Vide* Ashurst's *International Encyclopædia of Surgery*, vol. vi, article on Stone, by Dr. Keyes.)

the bladder, and Clover contrived the rubber aspirator and large-mouthed catheter, which differ but little from those which are now in constant use. It is with a feeling almost of chagrin and regret, that I recall the fact that, as regards the suprapubic operation and litholapaxy, with Garson's plain hints as to the one, and Clover's helpful appliance in the other, English lithotomists and lithotritists should have overlooked the true meaning of these hints, and have left it to Petersen and Bigelow to recognise their intrinsic principles, and to adopt and fully introduce them into practice. It is true that Brodie, more than forty years ago, removed fragments of stone by suction, but he only advised it for the final fragments in a paralysed bladder. It is also true that, with Clover's rubber bottle and catheter, some of us have tried to clear bladders that could not clear themselves; but none of us had realised or thought of the possibility of attacking and removing at one sitting an ordinary stone from a healthy bladder. Otis's discovery, if I may so describe it, of the full dilatability of the urethra without injury, paved the way for the introduction of litholapaxy. Bigelow saw clearly enough that, without a full-sized evacuating catheter, the removal of any but small stones could not be effected at one sitting, but that with it, and with lithotrites of adequate strength, the field covered by lithotrity would be greatly extended. This anticipation has been abundantly proved ; the principle of the proceeding is good and sound, and the practice is brilliant and successful. But, while admitting and maintaining this position, I am not unaware that there is some drawback to this picture ; that it is held by many surgeons, and, amongst them, some of the most eminent, that the success of lithotrity is, in too many cases, temporary, and not permanent ; palliative, and not radical; that, while the immediate result is good and satisfactory, the future history of a patient relieved by lithotrity too often is full of trouble, caused by persistent bladder-disease and frequently recurring stone. I cannot deny that there is some ground for this adverse opinion ; how much, I will endeavour to show. In the meantime, let me say a few words as to the operation, and then as to its application to children, to adults, male and female, and to the aged.

Litholapaxy.—I have followed the usual method of operating. The urinary organs and urine are first brought into as favourable a condition as possible, by rest and appropriate treatment. I invariably begin an operation with a fenestrated lithotrite of adequate size. The stones most frequently met with in the eastern counties are generally composed of pure uric acid, and are of intense hardness ; so hard are they, that it has sometimes required my utmost strength of wrist, and the help of a towel folded round the handle of the instrument, to accomplish the first break of the stone. Dr. Freyer, in India, where very large stones are frequently crushed, has experienced this difficulty, and has suggested the addition to the handle of the lithotrite of a cross-bar, which would give great power, would save one's hand, and could be removed when not required for large and very hard stones. As the fragments diminish in size, the unfenestrated instrument comes to be the best ; it holds, crushes, and pulverises the fragments better, and makes quicker work. It is desirable that all lithotrites should have the female blade made rough, so as to prevent slipping of the smooth round or oval stones when caught. These stones are apt to slide out of the instrument and escape when the male blade is pressed down on them, but this rough surface enables the blades to grip at once. Great care should be taken to raise the stone towards the centre of the bladder before using the screw, so as to avoid contact with, and injury to, the mucous membrane. The evacuating catheters have varied but little from those first introduced by Bigelow. I have always used the curved, because it has seemed to me that the straight tube, when pressed down into the bladder, is not quite free from the risk of injuring, or even perforating, its walls, especially if they be thin and weak. It is important to keep the curved end of the catheter slightly pressing down the fundus of the bladder during the evacuation of *débris;* this is done with the left hand, while the eye of the experienced operator will ceaselessly watch and wander over the whole apparatus. If the aspirator do not quickly expand, this may be due to blockage from fragments, in which case the characteristic click will be heard, or it may result from a portion of mucous membrane becoming entangled in the aperture, or from the end of the tube having been inadvertently withdrawn into the prostatic urethra.

The aspirators are of various shapes. Bigelow, Otis, Berkeley Hill, Morgan, and Sir H. Thompson, have all separate patterns. I have tried most of them, and I must give the preference to Bigelow's last (*Lancet*, January 6th, 1883), or to that made by Down, with the addition of a funnel for easy filling; both have the glass receiver below the aspirator, and this has the decided advantage, that the water in it does not become quickly coloured with blood, and you can see at a glance how the evacuation is progressing and when fragments cease to fall into it. That which Sir H. Thompson prefers answers very well, but I have found it open to two objections. Some patients are apt to bleed, especially old prostatic cases; and small clots, with minute fragments of stone entangled in them, or shreddy mucus, become fixed in the hanging wire valve, and block, wholly or partially, the return stream into the bladder; moreover, the slightest stain of blood immediately reddens the fluid in the receiver and obstructs the view, so that it is not easy to see how the evacuation is going on. It is surprising how little water is required to be forced into the bladder at each squeeze of the aspirator; a tablespoonful is almost enough; much more than this will only disturb the bladder unnecessarily and hurtfully, and will not assist in extracting fragments.

It is very desirable that the entire stone should, if possible, be removed at one sitting. At one time, and with the habit, according to the old method, of dividing the treatment into several sittings, I was not unwilling to leave a portion of the stone for a second operation; with a full-sized stone, the proceeding is very fatiguing to the surgeon, and, moreover, as the stone diminishes in size, the smaller fragments are less and less easily met with, so that the inducement to make two sittings is strong. This, however, is a mistake; the bladder and urethra, injured and bruised to a slight extent as they necessarily are by the prolonged use of instruments, are far more likely to recover tone and health if there be no sharp fragments present to excite or keep up cystitis; therefore, there should be entire clearance if possible, even if this should require another half-hour of endurance on the part of both patient and surgeon.

Of immense importance is it not only to secure the removal of the chief bulk of the stone, but especially of the very last atom or final fragment, so that no starting point or nucleus may exist for recurrent stone or phosphatic deposit. This has always been the difficulty and defect of lithotrity by the old method; but it is claimed for the new that, with the evacuating catheter and a good aspirator, there is no difficulty in removing the last fragment. I can fully coincide with this view when we are dealing with a healthy, smooth, and vigorous bladder, but it is far otherwise with a half-paralysed, hypertrophied bladder, in which the muscular columns stand out, and the mucous membrane is pocketed, as it were, between them; where the prostate projects backwards, and pouches are formed on one or both sides of or below it. In such cases as these, and they are frequent in practice, I do not hesitate to say that no evacuating catheter, and no aspirator, even in the most skilful and experienced hands, can with certainty ensure the extraction of every minute fragment; the suction-action of the aspirator extends but very little distance from the opening in the evacuating catheter; and we cannot explore all these recesses, pockets, and pouches. Tiny atoms become hidden; they mingle with small clots of blood, and with mucus, and cling around and amongst these irregularities of the lining membrane; and although clots and mucus are readily drawn up through the catheter, we can never be sure that all are removed. Even Bigelow, who is certainly not willing to admit any defect in the operation, and whose manipulative skill is perfect, confesses that "we fail to discover a last fragment in some bladders, even by repeated washing" (*Lancet*, January 1st, 1883).

Advocate as I am of the new lithotrity, I feel constrained to admit this difficulty with the final portions of stone, and further to admit that to it is due, as I shall presently show, the great tendency to recurrence of stone and phosphatic deposits which are lamentably prone to follow lithotrity in a certain class of cases.

The causes of death after lithotrity deserve the closest attention; they point out the dangers which beset the operation, and the accidents which may happen; and, when fairly described, they convey a great amount of information. In my own practice, I have seen eighteen deaths; the list is a long one; but as in lithotomy, when I remember the large number of old, neglected, and otherwise diseased patients I have had to treat, men who will only apply for aid when they can no longer work, with complications of various kinds and broken-down constitutions, I can almost wonder that the list is not longer. Sir H. Thompson, in speaking of the early detection of stone, says he has treated 100 cases of these small stones, with only one death. I can only say that I see but few of these desirable cases, and the recital of them almost excites envy.

The following table, giving the salient points of these eighteen fatal cases, show that, in four, the cause of death was independent of the treatment, and ought, perhaps, to be omitted from the list: namely, one each from angina pectoris, erysipelas of the head and face, apoplexy, and chronic bronchitis. In four at least, pyæmia was the cause, all being hospital-cases. Peritonitis occurred in five, in four of which there were sacculi, and the inflammation spread from them, and, in three of these, a stone, or fragments of stone, were found in the sacculi; in two, the bladder-wall was injured by the catheter; and in one there was pelvic abscess, caused by a false passage in the prostatic urethra. In more than half the deaths, kidney-disease was either the sole or, to some degree, a contributory cause of death.

Lithotrity in Children.—Until recently, lithotrity has been assumed to be unfit for quite young children; but our brethren in India have lately opened new views on this subject. I cannot mention Indian surgeons without bearing my testimony to the great and excellent work they are doing in the surgery of stone. They possess, especially those who reside in the north-west provinces, unrivalled opportunities of observation in the vast number of stone-patients who seek their aid; and it is a pleasure to recognise the sound and practical character of their published papers, while their operative skill is abundantly proved by the great success they have obtained. The papers of Dr. Freyer and Dr. Keegan are well known; while Drs. Beaumont, Anderson, Saunders, and others, have contributed much information. Dr. Beaumont, at Indore, I believe, first applied lithotrity to young children. In his early cases, he says: "I used no evacuating catheter at all, breaking the stones up very small with the small hand-lithotrite (No. 5), and the *débris* were passed safely, without the use of any evacuating instrument." He was succeeded at Indore by Dr. Keegan, who, at first, hesitated to apply litholapaxy to children, because of the great success of lithotomy; but, at the close of 1881, he began, and, in the *Indian Medical Gazette* of May, 1884, and June. 1885. he has reported

Deaths after Lithotrity.

No.	Age.	Sittings.	Remarks and Cause of Death.
1	72	2	Cystitis ; retention twelve days after last sitting ; prostate size of orange ; mucous membrane of bladder dark in colour.
2	76	1	Feeble man ; enlarged prostate ; alkaline urine ; stone hard ; eleven lines ; fever and cystitis ; abdominal pain ; died in twelve days ; bladder small and contracted ; thick walls ; mucous membrane dark ; a sacculus at lower and right side larger than bladder itself ; pieces of stone in it ; thin walls ; intensely inflamed and pelvic peritonitis around it ; prostate enlarged ; ureters dilated ; kidneys coarse and dilated.
3	75	1	Feeble man ; three stones ; death in fifteen days ; abdominal pain ; fever ; cystitis ; peritonitis spreading from sacculi at back of bladder ; sac walls thin, almost sloughy ; bladder large and dilated ; sacculi everywhere ; mucous membrane inflamed ; median lobe of prostate large ; kidneys healthy.
4	63	2	Came in with cystitis, having been crushed by surgeon a month before ; bad state ; great pain ; fœtid urine ; crushed once or twice, but he failed, and died in two months. Bladder inflamed ; sacculated one full-sized sac at apex contained two pieces of stone ; kidneys not unhealthy.
5	59	3	Stone and stricture ; dilatation up to No. 11 ; crushed twice, phosphatic stone ; urine alkaline, with muco-pus ; bladder improved, but he became ill with pleuro-pneumonia, and died five weeks after first crushing. Bladder small, mucous membrane inflamed ; a small piece only of stone remained. Prostate not enlarged. Kidneys congested ; right contained two small abscesses ; left a cyst with clear fluid. Right pleura contained three or four pints of turbid serum. Right lung collapsed, not inflamed ; left lung healthy. Pericardium universally adherent, thickened, and contained two large plates of bony matter, some inches in diameter ; at one part, the edge of this bony plate was the seat of a sloughy abscess, probably pyæmic.
6	59	3	Favourable case, crushed easily ; no bladder-irritation ; passed *débris* freely ; death from chronic pyæmia and suppurative nephritis six weeks after operation. Bladder healthy ; mucous membrane pale, a few small fragments of stone remaining ; abscess in both kidneys, in one lung, and in sterno clavicular joint.
7	62	3	Cured by lithotrity in 1871 ; recurrence ; crushed again three times 1874 ; retention ; peritonitis ; death three weeks after first sitting. Peritonitis chiefly in pelvic region. Bladder thick, not large. Mucous membrane not much inflamed, sacculated ; one sac at apex was sloughy, and communicated with peritoneal cavity by small round hole ; catheter, which was used every few hours by the house-surgeon and dresser, had evidently entered sac, and perforated its thin walls. Prostate enlarged, especially median lobe. Ureters dilated.
8	65	8	Tall, florid, free living man. In April, 1875, four sittings ; cured, but still an irritable bladder. Came again in February, 1876, with cystitis ; felt stone fixed at upper fundus, crushed with difficulty. Two or three sittings, under anæsthetics ; improved greatly ; suddenly attacked with alarming dyspnœa ; recovered ; another attack a week after, fatal. No *post mortem* examination.
9	74	5	Crushed five times ; all stone removed. Slight phlebitis of leg during treatment ; passed off ; was going home cured, when erysipelas of head and face came on ; proved fatal. Bladder healthy, no stone left. Prostate enlarged.
10	74	2	Multiple stones ; chronic retention ; fœtid, purulent urine ; feeble health ; rapidly declining. Two trivial crushings ; improvement in urine followed, but anorexia and debility went on, and he died of inanition in about a month. Bladder small, but not over thick ; mucous membrane dark in colour, and inflamed ; a sacculus as large as the bladder itself behind it, having an aperture of communication on the post-wall opposite the urethra ; its walls were composed of mucous membrane and peritoneum ; the former black and sloughy, and the peritoneum even looked dark and purple, the sac filled with thick pus and urine. Six small stones, some of them broken found in bladder. Prostate moderately enlarged.
11	67	1	Several stones ; all urine by catheter five or six years. For two years, pain and cystitis, with alkaline muco-purulent urine. Hesitated whether to cut or crush. Litholapaxy ; removed some *débris*, but left more. In few days, fever, cystitis, and nephritis : died

No.	Age.	Sittings.	Remarks and Cause of Death.
			two weeks after crushing. Right kidney atrophied; three ounces; ureter dilated. Left enlarged; eleven ounces; pelvis and ureter inflamed, and filled with offensive bloody urine and pus. Prostate large as an orange, median lobe projected far into bladder, deep pouch behind it. Bladder inflamed; hypertrophy with dilatation; numerous small sacculi, one large, one near left ureter, filled with calculus as large as walnut. Orifice of sac would just admit tip of forefinger; stone projected through it into bladder, and was rubbed smooth by contact with stones there. In bladder, two broken stones, and one larger unbroken one. Lithic acid covered with phosphates.
12	66	1	Multiple stones. Litholapaxy; 220 grains lithic stone, easily removed. Peritonitis, death in four days. Extravasation and sloughy tissue round the bladder, with pelvic peritonitis. Bladder rather small and thin; at back part of lower fundus was a hole, through mucous and muscular coats, large enough to admit tip of finger; margin of it covered with sabulous matter. Prostate enlarged.
13	66	1	Litholapaxy, stone of moderate size; in ten days, seemed almost well. Then had rigor, swelling of arm, acute pleuropneumonia, and died in four days. Pyæmic infarctions in kidneys and lungs, no actual pus, death came so quickly. Bladder hypertrophied with dilatation, honeycombed, mucous membrane pale; a few minute pieces of stone left.
14	68	1	Large hard lithic stone; enlarged prostate; litholapaxy; 400 grains red lithic *débris* removed; a good many fragments left, 150 grains passed, some impacted in urethra, and had to be picked out; fever ensued, swelling of one hand, urinary abscess in perineum, death in twelve days. Bladder hypertrophied, mucous membrane not much inflamed, piece of stone remaining. Prostate large, especially median lobe, which projected into bladder, like a large walnut; ureters large and convoluted; kidneys large, congested, and riddled with disseminated abscesses.
15	77	1	Hard lithic stone; 290 grains; litholapaxy; prostate large, tendency to bleed on slightest touch; bladder sensitive; abdominal pain; fever; bloody urine; death in four days. Over left kidney signs of inflammation, patch of lymph, and vivid injection on intestinal peritoneum adjacent; kidneys showed black hæmorrhagic infarcts; bladder of moderate size, but thick; mucous membrane injected and red, but not plum-coloured; no sacculi; some old clots, and a few small fragments of stone; prostate much enlarged, especially right lobe, which projected into lumen of bladder, and impeded use of instruments; very distinct and prominent "bar" at vesical orifice, and in front of it a deep prostatic sinus; mucous membrane on the bar slightly abraded.
16	73	1	Multiple small stones, easily removed by litholapaxy; some cystitis and retention; quickly removed by catheter and washing, but some vesical irritability remained. Seized with apoplexy on the morning of his going home; died quickly; enormous clot in corpus striatum. Bladder pale and healthy, free from stone; at apex was a malignant tumour, size of a walnut, in the bladder-wall; puckering peritoneum over it, and just showing through the mucous membrane; this was undetected in life, and caused the slight irritability left after the operation.
17	46	1	Large hard stone; crushed with large lithotrite and 18 tube, and removed 470 grains, leaving a few fragments, which were removed shortly after; only slight cystitis, and he was nearly well; then pain about the bladder came on, but not in micturating; fever and acute abdominal pain, and he died a month after operation. Peritonitis, beginning in pelvis; bladder perfectly healthy; no stone left; no cellulitis, but there was a large circumscribed abscess below it, on one side of rectum, containing healthy pus; this was set up by a false passage, leading into it from the prostatic urethra. Prostate rather increased in size; very deep prostatic sinus; lacunæ by side of vera-montanum very large. Into one of these the catheter, or some instrument had passed, and coursed under the mucous membrane, and led to the abscess; a small fragment of stone was entangled in the passage.
18	72	1	Red-faced man, with bronchitis and chronic cystitis; very ill, and getting worse; under chloroform, removed a soft phosphatic stone; bladder washed out daily, and urine became acid and clear; but he gradually became choked with bronchial phlegm, and died three weeks after operation. No *post mortem* examination.

forty-two cases, with only one death. The ages of the children varied from 2 to 11 years ; the weight of stone from 5 to 308 grains, the average being 128 grains ; the average stay in hospital was a little less than a week. In his first paper, he deprecated litholapaxy for stones composed of oxalate of lime ; but, in his last, he has given three cases of mulberry stones crushed, which weighed respectively 308, 230, and 200 grains, in boys of 11, 11, and 10 years of age. Keegan always uses fenestrated instruments, for fear of clogging by *débris*, and only those lithotrites and catheters which will readily pass without undue stretching. As in the adult, so in children, it came almost as a surprise for English surgeons to learn that proportionately large instruments could be easily passed into the bladder. English surgeons, and even Dr. Freyer, in India, have hitherto objected to the operation, because of the small urethra, the undeveloped genito-urinary organs, and the tender and sensitive mucous membrane in children, as well as the generally successful results of lithotomy. Keegan found that, in boys, there is great difference as to the size of instruments that are admissible. Speaking generally, boys of 4 to 6 will bear No. 7 or 8 lithotrite, and No. 8 or 9 evacuator, and boys of 8 or 10 will admit No. 8 or 10 lithotrite, and No. 10 or 12 evacuator. A No. 8 fenestrated lithotrite will easily crush a stone of two to three hundred grains. It is necessary to break up the stone very thoroughly. The evacuator, though proportionately large, is actually small ; and the operation, therefore, in children, occupies a longer time than in the adult, the average being rather over an hour. He contends that the bladder and urethra in children will bear rough handling quite as well as or better than in adults. They recover easily from the operation, as a rule. Some had swelling of the penis and prepuce, and some had pain in micturating for a few days ; but these symptoms yielded readily ; while in some, as in adults, it was requisite to slit the orifice of the urethra slightly, to gain admission for the proper instruments. Keegan concludes his observations by insisting on the following rules. "Use small fenestrated lithotrites ; if possible, crush the stone into fine powder ; and you will not then require large-sized catheters to evacute the *débris*. Never use a lithotrite or catheter which will not pass readily in and out of the bladder and urethra ; be extremely gentle and careful in practising all manipulations on the urinary passages ; do not be in a hurry to complete the operation ; use the aspirator freely, and never, if possible, leave a single grain of *débris* behind in the bladder ; and rest assured that, if all these conditions are fulfilled, you may count on a very large average of success. Some cases you will meet with where no lithotrite, however small, can be employed with safety, and those are the cases which should be dealt with by lithotomy." As I have quoted Keegan's figures, I have also thought it due to him to give his conclusions ; he speaks after full experience, and not from a few cases only.

The advantages of lithotrity in children over perineal lithotomy may be thus stated. 1. It is probably more successful ; the mortality of lithotomy is about 5 or 6 per cent. ; of litholapaxy, probably not more than 2 or 3 per cent. 2. There is no risk from bleeding, or from wound of the bowel or of the seminal ducts. 3. The recovery is much quicker. 4. It is probably easier of execution than lithotomy. In female children, there can be no question that, for small stones, it is the proper operation. Dr. Freyer, who has objected to lithotrity in boys, has adopted it in girls in several instances with success ; and in them it has not, as in boys, to stand the test of a rival lateral lithotomy. At the Clinical Society, lately, the subject was discussed, and the general tone of the speakers was one of cautious expectancy and reluctant assent. Personally, I have no experience of lithotrity in children : I do not often see stone cases in the very young, having operated on only thirty-one cases under 10 out of 300, and those were treated by lithotomy.

Lithotrity in the Adult, by which I mean the middle-aged adult, before the prostate begins to enlarge, and unfavourable bladder-changes occur, is capable of great things. In this period it achieves its greatest triumphs and its best results. In such cases, the kidneys are probably sound, and the bladder healthy ; it is smooth, fairly capacious, its contractility and nerve-power are unimpaired, and, above all, there is no impediment to the outflow of urine. The operation is easy of execution ; the complete removal of all the fragments can be accomplished almost with certainty, and, if any small portions be left, the patient will expel them with ease in a day or two. It is under these conditions that stones of full, and even great size, have been successfully removed. In this connection, the Indian surgeons take the lead. Dr. Keegan reports the case of a man aged 67, from whose bladder he removed a stone weighing about 3½ ounces. He used a No. 15 lithotrite at first, and for half an hour the stone was too large for the lithotrite to act by its screw ; during this time, he nibbled at its surface, and at length so diminished its size, that the screw came into action, and the stone was broken, and easily dealt with. He introduced the lithotrite fourteen times, and the largest catheter an equal number. On the third day, he extracted a small piece which had been left, and, on the fourth day, the urine was quite clear, and the patient went home. The operation lasted four hours, and the surgeon adds that, once or twice, he was on the point of relinquishing it through fatigue.

Dr. Freyer also gives two cases in which he removed stones, each weighing over three ounces, one composed of lithic acid and the other of oxalate of lime. In these cases the calculus was single; and I need not say that it is more difficult to break up and remove a large single stone than to deal with double the weight of small multiple stones, which are generally laminated and friable. There must, I conceive, be some difference between the texture and composition of these large Indian calculi, and those pure red uric acid ones, which I often meet with. I can hardly believe that any instrument capable of being introduced could break up an uric acid stone of three ounces, unless, indeed, these large stones should be found to yield more easily in proportion than smaller ones. These very large stones, however well they may exhibit the scope and power of Bigelow's brilliant operation, can only be considered as exceptional. They require not only a healthy and capacious urethra and bladder on the part of the patient, but also great skill, and not a little strength and endurance on the part of the surgeon.

I cannot help thinking that the Indian patient, with his frugal mode of living and generally spare habit, is a less inflammatory and safer person to deal with than the beer and spirit drinking, and often hard living Briton. It is true that lithotomy in India is not more successful than in England; but this operation is probably done by the many, skilful and unskilful, whereas litholapaxy is only practised by the few and the able.

Litholapaxy in the Aged requires a more qualified statement as to its merits, chiefly because, in them, stone is frequently accompanied by complications of one kind or another, which often lead to trouble, or imperfect results. When no complications are present, the operation is quite as successful in the very old as in the middle aged ; indeed, I think they bear the use of instruments better, and are less sensitive and resentful of interference.

The most common of all complications is prostatic enlargement. When slight, this is of little importance, but when it is considerable, it leads to changes in the bladder of a serious kind ; it may impede the free and efficient use of the lithotrite, and render the removal of all the calculous fragments difficult. There is generally some impediment to the escape of urine; this necessitates increased action of the bladder, but the necessity comes at a time of life when the nervous and vital forces are declining; and, as a result, we see, not the hypertrophy with contraction and thickening of the bladder, common in obstruction from stricture in early adult life, but hypertrophy with dilatation and thinning, and consequent inability to contract and empty itself either of urine, or of fragments of broken stone.

Prostatic hypertrophy seldom affects equally the entire gland; it may be of one or other lobe, or of the median portion almost exclusively; and, in this way, the urethral canal may be so displaced, that its devious course is not easily followed by instruments of a definite and awkward shape. But this irregular enlargement may, and generally does, project into the cavity of the bladder, and lead to the formation of deep hollows or pouches, not sacculi, on each side of, or behind and beneath, the prostate, in which broken fragments of stone will hide where it is most difficult to follow them, and from which it is sometimes impossible to dislodge them by any means, or by any instrument.

Again, prostatic hypertrophy, as I have already described, induces hernial protrusions of the mucous membrane between the muscular fibres, and sacculation in all its degrees and varieties. When a stone is broken in such a bladder, some trifling piece, or fine *débris*, may, at moments when the bladder is distended, find their way into one of these sacs, and lay the foundation of encysted stone and frequently recurring symptoms. The imprisoned fragment first fills the cyst; then, by continued accretions of phosphates, it grows up into the bladder like a mushroom, and is probably again and again nibbled off by the lithotrite, each time with temporary benefit to the inflamed bladder, until the patient dies, worn out with chronic cystitis and pyelitis.

This is no fancy picture, nor is it so rare as some lithotritists would have us believe. I have met with a considerable number of cases, some of which have been reported; and increasing experience proves to me that prostatic enlargement is a very real source of failure in lithotrity.

The risk of this entanglement of *débris* in sacs or pouches is probably lessened by the removal of the stone at one sitting, but it is by no means certainly abolished. By turning the aperture in the evacuating catheter towards these pouches, and by the free use of the aspirator in all directions, the fragments may be washed out of them and all removed; but it cannot be denied that it is always a serious matter to shatter a stone into innumerable fragments in a bladder of this description. On the other hand, lithotomy, either suprapubic or perineal, is an operation of magnitude, and of greater and more serious risk than lithotrity, so far as immediate results are concerned.

Recurrence of Stone after Lithotrity.—Although the immediate and direct mortality of lithotrity is small, the recurrence of stone is lamentably frequent. In my own list of 133 cases, there were eighteen in which recurrence, one or more times, took place, being about 1 in 7. Sir H. Thompson, with a much larger number of cases, gives about the same proportion. I am disposed to infer, however, that recurrence is more frequent even than this, because it is not likely that all who get relapse apply to the same surgeon again. Living, as I do, in a local centre, and drawing cases chiefly from a limited area, I am probably more able to trace, and more called on to treat, those who suffer a second or third time, than he who lives in the metropolis, and draws his cases from great distances. Patients may, and frequently do, apply to the same operator once or twice; but, after a time, they either apply to their own surgeon, or they decline further treatment; and too often their subsequent history is one of painful endurance of chronic bladder-disease and gradual exhaustion. If, moreover, there be added to the list those numerous cases of phosphatic deposit or concretions so frequently noticed after lithotrity, the relapses would, I believe, reach to nearly 20 per cent. This seems a heavy indictment to bring against lithotrity, but I am afraid there is no gainsaying it; and, if so, it would be wrong to pass it over, or make light of it. Many of these relapses might be prevented if the patients would observe directions, and persevere with treatment. It certainly is so with the unenlightened and uncomplaining hospital patient. Feeling himself well, or what he considers well, he goes to his work, and neglects the use of the catheter and other means; and, instead of returning in a month or two to have his cure certified, or a minute remaining fragment removed, he toils away as long as he can, and returns, perhaps in a year or two, with a fresh uric acid stone, or with chronic cystitis, and a phosphatic one. The educated, sensitive, private patient, on the other hand, will watch his symptoms narrowly, and return if the slightest indication of the old trouble should reappear. It is this difference which makes lithotrity in hospital practice sometimes disappointing and unsuccessful.

This frequent recurrence must be due either (1) to the descent of a fresh stone from the kidneys, or (2) to a fragment of stone having been left at the first operation. As to the descent of a fresh stone: there can, of course, be no doubt as to the occasional occurrence of this cause, just as we see it occur after lithotomy. The bladder being entirely cleared of stone, there will be the same liability to the descent of a fresh renal calculus after one operation as after the other. What, then let me ask, is the fact as to lithotomy? I have already shown that there were only 21 cases out of more than 1,000 of lithotomy at the Norwich Hospital, in which recurrence was clearly traced to perfectly fresh formations coming like the first, from the kidney, or about 1 in 50; whereas, in Sir H. Thompson's list of about 600 persons treated by lithotrity, he mentions 61 cases in which he operated twice, 9 three times, 3 four times, and 2 five times; 75 in all, or about 1 in 8. The inference from these data seems to me to be inevitable, that relapse of stone after lithotrity is chiefly due to other causes than the descent of a fresh renal stone. To my thinking, the majority of recurrences is caused by the great difficulty in insuring the complete removal of all the *débris*; I have already referred to this in old persons, with enlarged prostate and feeble atonic bladder, and it is this class of patients who are especially liable to relapse. I have traced this in my own cases, and, I may also add, in cases of other and better lithotritists than myself, too often to have any doubt in my mind.

It is frequently said, and it is quite true, that lithotrity is often followed by a tendency to phosphatic deposit in the bladder, and this tendency constitutes one of the chief objections to the operation. Thus, Sir H. Thompson says, "many who submit to lithotrity, become afterwards the subjects of chronic cystitis and phosphatic deposit, sometimes to a distressing extent" (*Medico-Chirurgical Transactions*, vol. lxi, p. 175). Dr. Freyer also says, "In prostatic enlargement, the disease (stone) frequently recurs, owing to the fact that the bladder is never completely emptied of urine during micturition" (*Lancet*, March, 1885). Why, I would ask, should this special tendency to phosphatic deposit ensue after lithotrity? Not, I think, as Dr. Fryer would have us believe, because of vesical incompetence and residual urine.

It is admitted that, in ordinary cases of prostatic hypertrophy, with atony and "catarrh" of the bladder, when no stone has ever existed, there is little or no proneness to phosphatic deposit. However fetid, alkaline, and loaded with mucus the urine may be, no phosphatic deposit will take place in the bladder, except on some pre-existing nucleus. In such a bladder, we know how soon a catheter becomes encrusted; and similarly, if a clot of blood, or any foreign body, or even an abraded surface or a new growth exist, phosphatic deposit will soon take place. Without some kind of nucleus, no deposit will occur. The mucous membrane with its epithelial covering has probably some inherent vital power, which seems to guard it against deposit of calculous matter ; remove the epithelial covering, and deposit may occur at once on the rough surface. After lithotomy, how often do we see this phosphatic deposit along the tract of the wound, but it is not found on the mucous membrane, unless some ulceration or abrasion has taken place.

I think I am justified, therefore, in saying, that when phosphatic deposit (call it concretion or call it stone) follows lithotrity, it is, in the large majority of cases, engrafted by aggregation on a fragment which, notwithstanding all the skill and care taken, has been overlooked at the first operation. This consideration should make us pause before breaking up a stone in an atonic bladder ; I have often felt some misgiving in doing it. With the aspirator and evacuating catheter, we may hope to succeed in clearing out all the *débris* from these bad bladders better than we could by the old method ; but even with this improvement, as Bigelow says, "we fail to discover a last fragment in some bladders even by repeated washing."

On the other hand, what better alternative is open to the surgeon ? Lateral lithotomy is a harsh proceeding and more immediately perilous to life ; and, moreover, it is not itself wholly free from the danger of leaving a portion of a broken stone behind. Suprapubic lithotomy, should it prove to be, in its modern form, more successful than it formerly was, may come to supplant not only perineal lithotomy in this class of cases, but lithotrity also.

Selection of Operation for Stone.—This is a subject of no small difficulty in many cases. The size of the stone, or, if more than one be present, the total amount of them ; the condition of the kidneys, bladder, and prostate; the temperament and general health of the patient ; his class in life ; co-existing diseases and complications, if any ; the surgeon's own experience and facility in manipulation ; all these have to be duly weighed. An experienced hand will generally make a tolerably accurate estimate on these points, but mistakes are not unfrequent. For example, measurement of a stone is sometimes apt to mislead. A month or two ago, I introduced a No. 12 lithotrite into a man's bladder, and found a stone which measured over two inches, while the screw reached only two inches exactly. I hesitated, and for a moment felt inclined to do lithotomy. Finding, however, that the bladder was healthy, and the prostate not large, the urethral orifice was incised a little so as to admit a full-sized instrument; the stone was quickly and easily disposed of, and the *débris* weighed only 480 grains. No doubt this was a flattened oval stone which had been seized in its long diameter. Again, when two or three stones of unequal size co-exist, it is easy to pick up the smallest over and over again. We are thus led to think that only a moderate amount of calculus is present, whereas, when the small one is disposed of, surprise, and even dismay, are felt when a still larger one is grasped. Again, when more than one stone is suspected, it is customary to seize one, fix it in the instrument, and proceed to sound afresh ; this, however, may mislead ; for, a stone having been grasped by the tips of the blades, and moved about in the bladder, it will sometimes rotate a little in the blades of the lithotrite, and communicate a grating feel to the hand which is very like touching a second stone. A glance over the recently reported cases of the high operation will show how repeatedly the operators were mistaken on some point, either as to the size of the stone, or the condition of the bladder, or their ability to seize the stone. All this demonstrates, not that there was any want of skill, for the skill was of the best, but that, in not a few cases, there are inherent difficulties in coming to a correct conclusion as to the proper choice of the operation. I confess to having sometimes felt regret that I resorted to lithotrity when some unforeseen circumstance showed me that lithotomy would have been the better operation ; and I have not seldom seen patients subjected to the risk of lithotomy when the milder plan by crushing might easily have been adopted.

Permit me to summarise the views, as to choice of operation I have attempted to enforce in these lectures, in a few propositions, which, if they are somewhat indefinite, are still the nearest approach to rules of practice which our present knowledge on some points seem to me to admit of.

1. In children, litholapaxy should be more adopted than has hitherto been the custom.
2. In male children, when the stone is at all large, the suprapubic will probably prove to be easier to do, and safer than, the perineal operation.
3. In female children, litholapaxy should be the rule for small stones and the high operation for all large ones.
4. In adult females, litholapaxy, or dilatation and extraction, should be adopted for stones of moderate size ; vaginal lithotomy for those somewhat larger ; and the high operation for those decidedly of large size.
5. In adult males, litholapaxy should be the rule for stones up to an ounce or an ounce and a half ; above that size, lateral, or possibly suprapubic lithotomy—certainly the latter for all stones over three ounces.
6. In the aged, the same rules apply when the urinary organs are healthy ; but when the prostate is large and the bladder atonic, suprapubic lithotomy should be more adopted, until its success or failure is demonstrated.

Conclusion.—I cannot close these lectures without thanking you, Mr. President and gentlemen, for your courteous attendance. No one is more sensible than myself of the imperfect and halting way in which much of this important department of surgery has been treated. This is due, not alone to my deficiencies, but, also, to the transition state in which we seem to be with regard to some questions relating to the operative treatment of stone in the bladder. There are some amongst us, and those fully entitled to guide professional opinion, who prophecy that the old and historic operation of Cheselden will shortly disappear, and be no more witnessed in our hospitals ; that this will give place to newer methods, or older ones in a new form. Should this prophetic view of what the next generation of surgeons are likely to achieve be true; should the time-honoured lateral operation become obsolete, and all its literature merely a curiosity of history, and should the life's work of men of my standing be thus proved to have been more or less wrong, and should come to be replaced by other and better methods—we shall submit to the inevitable; shall even, with open minds, adapt ourselves, in what remains for us to do, to the new order of things ; shall, perhaps, bear a part in shaping or correcting these new proceedings, and shall rejoice greatly if the result be that suffering is diminished and life prolonged. At present, however, this is but a prophecy, waiting for fulfilment or failure ; and, while waiting and watching, I am thankful that I have been permitted to cast a retrospective glance at what I have seen and done in the surgery of stone in the bladder, uncomplaining if it should prove to be merely a record of bygone work, but abundantly content if it should afford a few useful hints for the guidance of my younger brethren.

AN ADDRESS ON THE ETIOLOGY AND DISTRIBUTION OF STONE IN THE BLADDER.

Mr. President and Gentlemen,—When, by the favour, and at the suggestion of my local friends, and with the approval of the Council of this Association, I was chosen to address you to-day, I accepted the honourable responsibility, and, in doing so, took counsel rather of my vanity than of my discretion. To some, whose mental activity is great, and whose pen moves glibly, the opportunity would be esteemed, as indeed it is, a golden one. To me, with unready thoughts and with unpractised pen, who delight rather in reflection and contemplation than in speech or written words, the honour was—I may as well confess it—more oppressive than pleasing.

Having, however, accepted the duty, I shall perhaps best explain, I may almost say apologise for, the scope and object of my address, if I recount the thoughts which passed through my mind while in quest of a subject.

A retrospect of Surgery, compassing the time during which I have been in active work, came first to my mind; but this has been so often, so ably, and so recently done, that the intention was dismissed almost as soon as it presented itself. I turned next to the records of my own experience, feeling sure that these must contain materials enough, if properly set forth, to furnish an hour of interesting commentary; but though, on looking through my notes, I found instructive illustrations of disease, and curious and important cases in abundance, they seemed to display no special features, either of pathology or of treatment, worthy to occupy such an audience.

The novelties of surgical practice, introduced during the last year or two, are scarcely sufficient or scarcely important enough to constitute a theme. They are chiefly comprised in Esmarch's bloodless system of operating, and Dittel elastic ligature; concerning which I will only say that the first is not a novelty, having been practised by one our members many years ago; and that the second is, in my opinion, more curious than useful, and not worthy of a place either in the records or in the practice of surgery.

One great subject there is, which, if not exactly a novelty, is of recent time, and is still waiting for a solution, both as to its facts and as to the theories held to account for its facts; I mean the germ-theory of putrefaction and antiseptic surgery. This subject, for I associate them, I deem to be of surpassing importance and interest. Underlying, if not undermining, much of the existing fabric of surgical pathology and practice, it cannot be too often brought to the bar of professional criticism; for on its right solution, whether it be true or not, depend a multitude of points in daily practice, and even, probably, the lives of many of our fellow-creatures. This subject would certainly have been my choice but for two considerations. More than one influential member of the medical press proposed, at the commencement of the year, to make and carry out a full investigation of the entire question—a proposal which, however, still remains for fulfilment; and I felt, moreover, that, in our sectional meetings, papers by most competent men would probably be forthcoming, and would lead to searching discussion.

Turning, then, from these topics, my thoughts reverted towards home, and fixed themselves on that subject which, for every Norfolk surgeon, possesses an undying interest, and which, for all practitioners, from some point of view, may be presumed to have considerable attraction. The city in which we are now gathered is the centre of a district in which cases of renal and vesical calculus are supposed to be, and probably are, more frequent than in any other part of the world. The explanation of this frequency is so often demanded of one, both in professional and in non-professional society, and is so difficult to give, that I propose to discuss the subject from this point of view, and this alone, not touching, except incidentally, on the question of treatment, about which over much has already been written. I propose further to narrow the question by limiting it to one form of stone, namely, that composed of lithic acid and its salts, which, I need not say, constitutes at least five-sixths, or, more probably, so far as this district is concerned, nearly nine-tenths of all primary formations. While, however, I thus limit the inquiry to this one species, it will be understood to include not merely the accidental occurrence of vesical stone, but the diathesis out of which stone arises; indeed, I have now only to do with calculus in the bladder, in that it expresses, roughly and approximately, the relative frequency or rarity of the lithic diathesis, just as the mortality in any place or district may be taken to represent, roughly and approximately, the amount of sickness in that place of district. For one case of stone in the bladder which presents itself, there are ten at least met with in which the lithic diathesis, or as it may for convenience be called "lithuria," is fully marked in the form of lithic deposit, sand or gravel. Let us, then, inquire—1. Is lithuria, as represenled by cases of stone in the bladder, more common in this district than in any other part of the United Kingdom? and 2, If it be, what explanation can be given to account for the excess?

The subject has on more than one occasion undergone investigation. Just a hundred years ago (*vide a Medical commentary on Fixed Air*, by Matthew Dobson, F.R.S., 1785), Dr. Dobson, of Bath, in an inquiry on the disposition to stone in the cider counties compared with some other parts of England, demonstrated that stone abounded most in the eastern or Norfolk district; that the north-eastern, including Newcastle, York, Leeds, and Manchester, stood next in frequency; that the north-western, including Liverpool, Chester, Shrewsbury, and North Wales, had the fewest cases; and that the cider counties of Devon, Gloucester, Worcester, and Hereford, had nearly the same as the north-eastern. About fifty years ago, Mr. Smith of Bristol went over the same ground, but more fully than Dobson; and speaking generally, it may be said, he met with similar results—that stone abounded, above all other places, in Norfolk; that a larger proportion was found in the eastern than in the western district, and that Ireland and Scotland were comparatively free from the disease (*vide Medico-Chirurgical Transactions*, vol. xi).

Dr. Yelloly, in 1830, still further elucidated the subject, and found that, in Ireland, calculus was very rare, especially in its country population; that in many counties no operation for stone had been practised in any of its hospitals, and in some districts the disease was almost unknown. In Scotland, he found as much variation in frequency in different parts as in England; in the very northern counties it was very rare; in Aberdeenshire the proportion was more considerable; in the southern and south-western districts it was exceedingly rare; while both he and Mr. Copland Hutchinson (*vide Mediço-Chirurgical Transactions*, vol. xvi, p. 94) showed that, taking the whole country generally, stone was as frequent in Scotland as in England; and that in both it was much more frequent in town than in country populations (*vide Philosophical Transactions*, 1829 and 1830).

In my own investigation, (1) I have consulted the Registrar-General's reports for the last five years for the United Kingdom; (2) I have applied to one of the surgeons—generally to the senior surgeon—of nearly all county hospitals, and of all others having a considerable number of beds, or of those likely to admit and treat stone-cases; and I desire now publicly to express my deep obligation and warmest thanks to those gentlemen—and they include nearly all to whom I applied—who have so promptly, so courteously, and so fully answered my inquiries. The information obtained will appear in a table comprising all the cases received into the various hospitals during the last five years; the number of children under 10; the average age; the number of beds and the proportion of stone-cases to the whole number of in-patients, with incidental remarks by my various correspondents. I am aware that both these sources of information are open to criticism and objection, on the score of inaccuracy. The Registrar-General's reports, especially those from Ireland, are admitted to be faulty; the causes of death are often vaguely and carelessly stated; frequently no certificates are given, and the true causes of death are overlooked; but, where the numbers are large, and the statistical system on which the various data are constructed is the same from year to year, it is probable that a near approach to truth and comparative accuracy is really obtained. So far as hospital records are concerned, they are doubtless, more nearly accurate in themselves; but the inferences to be drawn may be vitiated by various causes; thus, eminent and successful operators may attract cases from great distances, so as to make it appear that a larger proportion of stone exists in some particular districts than is actually the case, and, therefore, a less proportion in others. This disturbing cause, perhaps, is chiefly found in the metropolis and in some of the large cities: but, so far as London is concerned, I have ascertained the locality from which each case was derived, so as to allocate each to its proper county, while out of London this vitiating cause does not probably materially affect the result; the result being that, in almost all cases, the returns from the various hospitals fairly represent the amount of stone, and therefore of lithuria, existing amongst the poorer classes of the population surrounding those hospitals. Another source of inaccuracy arises from the increase in number of hospitals, of cottage hospitals, and of dispensaries which contain a few beds, in all of which operations are occasionally performed. Further, there are many surgeons unconnected with hospitals who deal, and deal generally very successfully, with the cases occurring in their own immediate neighbourhood; but these, though they are many in the country at large, are but few in each county, and do not greatly disturb the hospital averages. In Norfolk, for instance, where stone-cases are quickly detected and keenly watched, and where certainly there are plenty of capable and enterprising surgeons, I do not believe that more than six or eight cases are annually operated on in the county, while the various hospitals continue to maintain their full average numbers.

Taking, then, the mortality from stone, the Registrar-General tells us, that, in England, there are more than twice as many deaths from stone as in Ireland in proportion to population.

Yearly average of Deaths from Stone for Five Years ending 1871 in proportion to Population and to whole number of Deaths.

	Deaths from Stone.	Of Population.	Of all Deaths.
England and Wales	200	1 in 100,331	1 in 2,467
Scotland......................	59	,, 51,903	,, 1,200
Ireland	27	,, 214,740	,, 3,354

In Scotland, there are twice as many deaths in proportion to population as in England, and four times as many, therefore, as in Ireland. Further, it appears that, in the northern counties of Scotland, there are nearly four times as many deaths from stone as in the southern counties, the population being nearly equal. Similarly, in Ireland, the mortality is three times as great in the northern counties as in the southern. In England, the mortality from stone has increased during the last five years. For several quinquennial periods, there was a steady decrease, which led to the belief that stone was really a diminishing disease; but this inference, I fear, was erroneous; all the evidence I have been able to collect tends to show that it is just as frequent as ever, and that the apparent diminution was due rather to better treatment, more willingness to submit to operation since the introduction of anæsthetics, and especially to greater nicety and accuracy in discriminating the causes of death. For instance, in 1840 there were 303 deaths from stone, and 132 from cystitis; while in 1870 there were 195 deaths from stone, and 415 from cystitis. This remarkable discrepancy is due, not to any real difference in the relative proportion of the two diseases, but in the more exact appreciation of the real causes of death. As in Ireland and Scotland, so in England, the mortality varies greatly in the different registration districts. The northern and north-western counties show the smallest mortality and the eastern counties the greatest, being in the proportion of nearly one to four; next in amount of mortality to the eastern are the south-eastern and south midland counties. Yorkshire, Wales, and London show a medium mortality, and the west midland and south-western counties have almost as small a mortality as the north and north-western.* These facts appear in a table showing the number of deaths in five years, and the proportion to population, and the whole number of deaths in each district.

Mortality from Stone in England and Wales in Five successive Quinquennial Periods.

1847 to 1851,	the average of deaths was	... ...	232
1852 to 1856,	,, ,,	... ...	216
1857 to 1861,	,, ,,	... ...	184
1862 to 1866,	,, ,,	... ...	168
1867 to 1871,	,, ,,	... ...	200

Yearly average Mortality from Stone for Five Years in each Registration District in proportion to Population, and total number of Deaths.

District.	Yearly Deaths.	Of Population.	Of Total Deaths.
1. London	40	1 to 70,099	1 to 1,904
2. South-Eastern	22	1 to 83,978	1 to 1,829
3. South Midland	15	1 to 86,367	1 to 1,882
4. Eastern	18	1 to 63,475	1 to 1,319
5. South-Western	9	1 to 203,985	1 to 4,093

District.	Yearly Deaths.	Of Population.	Of Total Deaths.
6. West Midland	19	1 to 128,216	1 to 3,028
7. North-Midland	15	1 to 85,959	1 to 1,928
8. North-Western	14	1 to 209,681	1 to 6,187
9. Yorkshire	26	1 to 77,520	1 to 2,132
10. Northern	6	1 to 191,895	1 to 5,459
11. Monmouthshire and Wales	17	1 to 77,202	1 to 1,721

Proceeding to further detail, I have ascertained the mortality in each county of England and in London and Wales for five years, in proportion to population. This calculation, although accurate in the main, is open to this objection—that the number of deaths even in five years is too small in many of the counties to be above the reach of accidental fluctuation. Moreover, the deaths in London do not quite accurately represent the mortality for London proper, because the hospital population of the metropolis is drawn from various distances, and especially from the home counties, thus, at the same time, diminishing the mortality in those counties. Making, then, some small allowance for these slight sources of error, it appears that the greatest mortality obtained in these six counties, in the order named—viz., Norfolk, Huntingdonshire (a small population), Kent, Sussex, West Riding of Yorkshire, and Leicestershire; that the smallest mortality obtained in these six counties, in the order named—viz., Cheshire, Cornwall, Cumberland, Hampshire, Durham, and Devonshire; while the other counties hold a varying position between these extremes; the extremes being, that in Norfolk there is one death from stone yearly in 42,000 and odd, in Cheshire there is one in 425,000 and odd.

Mortality from Stone in Five Years ending 1871, in the several Counties, and the Annual Death-rate in proportion to Population.

	Deaths in Five Years.	Population.
Norfolk	50	1 in 42,744
Huntingdonshire	5	,, 59,137
Kent	45	,, 60,585
Sussex	30	,, 61,139
Buckinghamshire	12	,, 61,335
Yorkshire (West Riding)	94	,, 61,405
Leicestershire	19	,, 64,115
Monmouthshire and Wales	74	,, 78,140
Warwickshire	48	,, 65,670
Shropshire	20	,, 66,750
Suffolk	25	,, 67,081
Hertfordshire	13	,, 68,250
London	201	,, 69,500
Cambridgeshire	13	,, 69,845
Yorkshire (North and East Ridings)	34	,, 71,475
Worcestershire	23	,, 73,100
Staffordshire	57	,, 76,965
Northamptonshire	14	,, 82,525
Berkshire	11	,, 93,470
Westmorland	3	,, 101,575
Middlesex	9	,, 104,065
Lancashire	61	,, 108,145
Derbyshire	12	,, 122,485
Nottinghamshire	13	,, 124,530
Gloucestershire	18	,, 135,765
Bedfordshire	5	,, 140,479
Oxfordshire	6	,, 142,690
Northumberland	12	,, 142,925

	Deaths in Five Years	Population.
Wiltshire	8	,, 145,610
Essex	13	,, 146,040
Herefordshire	4	,, 150,900
Dorsetshire	6	,, 151,825
Surrey... •	13	,, 183,150
Somersetshire...	12	,, 193,070
Devonshire	15	,, 196,426
Hampshire	11	,, 207,570
Durham	11	,, 246,420
Cumberland	3	,, 342,125
Cornwall	5	,, 364,846
Cheshire	8	,, 425,520

Turning now to the hospital records, it appears that they agree fairly with the Registrar-General's returns, with one exception, to be presently mentioned. Application was made to between eighty and ninety hospitals in England, Scotland, Wales and Ireland, and reports have been received from between seventy and eighty; and these reports, besides containing the number of cases admitted during the last five years and the respective ages of the patients, contain also, in very many instances, results of treatment and practical remarks of great interest and value, which, however, I shall for the most part reserve for future use, merely quoting those which bear upon the present inquiry.

It would be impossible to read in detail the following abstract, but I will cull from it the most salient points, merely premising that the column expressing the proportion of stone cases to the whole number of in-patients has been constructed on the principle that the admissions of 1872 were assumed to be the average of the five years. It must also be borne in mind that all hospitals do not admit patients on the same grounds; a small hospital, having but few beds and narrow income, would admit all the stone-cases belonging to its area, but would necessarily restrict the admission of general cases to the more urgent ones; hence the proportion of stone-cases would appear greater in small than in large hospitals, and especially so in stone-districts. For instance, we have in this city a Children's Hospital containing twenty beds, in which the proportion of stone to other patients is one to thirty, and similarly, in the small hospitals of Yarmouth, Lowestoft, and Peterborough, there appears an undue proportion; but, taking the general run of county hospitals and hospitals in large towns, they are probably guided by the same method in their admission of cases and the relative number of stone to general cases, does in them give a fair picture of the amount of lithuria in each district.

Beginning, then, in this county, where undoubtedly there is the greatest amount of stone, permit me to say a few words specially of the Norfolk and Norwich Hospital, which has long held a position of authority in all matters in which this disease or diathesis is concerned. The hospital, which is now a trifle over one hundred years old, presents, in the accuracy with which its books have been kept, a model for all hospitals. From its opening to the present time, I have without difficulty ascertained the name, age, and residence of every stone-case, and where any doubt existed, the doubt was in the mind of the surgeon; there is no ambiguity in the records. Every stone which has been removed, either during life or after death, became the property of the hospital, and, to the number of about 1050, may be seen forming a noble contribution to the annual museum of this Association now on view in the adjacent room.

Including renal and urethral calculi, there have been admitted about 1270 males and 56 females. From this record, it would, I think, be easy to show that, so far from stone being a diminishing malady, it is rather an increasing one, even beyond that which the increase of population would account for. In 1773, there were nine cases admitted; in 1873, there were twenty-five. In the earlier year there were barely half the present number of beds, it is true; on the other hand, Suffolk had no hospital then, and the patients were drawn from a vastly greater area than now. This record also goes far to show that the sanguine and somewhat romantic view, that stone would come to be "stamped out," expressed by a distinguished friend of mine, has but little chance of fulfilment. During the last five years, the period chosen for comparison, there were 90 cases of stone admitted into the Norfolk and Norwich Hospital, or one to 55 of all in-patients. In the Lynn Hospital, there were 20, or one to 124 in-patients. In the Yarmouth Hospital, 21, or one to 32 in-patients. Now let us compare this with one of the hospitals in the south-western district—the Devon and Exeter Hospital, in which were admitted six cases, or one to 1300 in-patients; or with the Taunton and Somerset Hsspital, in which, with ninety-two beds, no stone case has been received in five years, and, my informant adds, only two in forty years. This, however, is an extreme instance; in very many hospitals fit for comparison with our own, the proportion of stone to general cases varies from one to 200, or one to 400; but there is a midland district, having for its chief towns Birmingham and Wolverhampton, in which not only do stone-cases prevail largely, but prevail especially in children. In the Wolverhampton Hospital, 50 cases have occurred in five years, or one to 101 admissions; of these 50 cases, 37 were in children under 10 years. In the Birmingham hospitals, the General, Queen's, and Children's Hospitals, 127 cases were received, of which 69 were under 10, and the same fact will appear in the report from other and smaller hospitals in the same district. Compare this with the Norwich cases; out of the 90, only 18 were under 10; but the contrast is greatest if we compare it with the Aberdeen Infirmary, which admitted 47 cases in the five years, of which only 3 were under 10. Some explanation of this singular contrast I will presently give.

The metropolitan hospitals will speak for themselves, so far, that is, as my information goes; but they scarcely come into comparison with ordinary provincial infirmaries. The hospital reports from Ireland, so far as they go, bear out the Registrar-General's reports as to the very small amount of lithuria in that happy land. Even in Dublin, a stone-operation, my informant says, is an "event."

In Scotland, hospital experience does not seem to be in accord with the death-rate. The admissions to hospitals would lead me to think that stone is less common there than in England; but the mortality would seem to be nearly double. This discrepancy is not easily to be accounted for, and I cannot help thinking either that imperfect discrimination of the causes of death has been made, or that, in the snatches of leisure during which I have compiled the table, some error on my part has crept in. I can conceive that, in the vast areas where population is small and surgeons are few and distant, many patients, who in England would be cured in a hospital, may in Scotland be allowed to languish and die of stone; but it is going too far to suppose that these considerations fully explain away the difficulty. Another mode of viewing the matter exhibits the discrepancy still further. Thus, in Scottish hospitals containing altogether 2151 beds, there were admitted, in five years, 171 stone-cases. In English provincial hospitals, taken promiscuously (and not including Norwich), containing 2183 beds, there were admitted, in five years, 354 stone cases, or more than twice as many as in Scotland; while, in seven London hospitals containing 1958 beds, there were admitted 229 stone cases; in other words, one stone case to about thirty beds in English provincial hospitals; one to forty in London, and one to sixty in Scottish hospitals. This matter, therefore, I leave for further and more careful investigation.

Table showing Number of Stone Cases admitted into various Hospitals during Five Years, ending in 1873, *with the average Age, Number of Cases under Ten Years, and the Proportion Yearly to whole Number of In-patients.*

Hospital or Infirmary.	No. of cases in Five Years.	No. below Ten Years of Age.	Average Age.	No. of Beds.	Proportion of Stone Cases to whole number of In-patients.	Remarks.
Yarmouth Hospital	21	15	15	28	1 to 32	
Peterboro' Infirmary	10	3	36	42	,, 53	
West Norfolk and Lynn ..	20	10	24	48	,, 124	Drinking waters hard.
Children's Hos., Norwich	9	0	0	20	,, 30	
Norfolk and Norwich Hos.	90	18	48	140	,, 55	
Lowestoft Infirmary	10	5	29	30	,, 77	
Wolverhampton Hospital	50	37	11	200	,, 101	A group of hospitals, in which a large proportion of cases are in young children; drinking water very hard.
Birmingham "General"..	61	18	32	256	,, 229	
,, "Queen's" ..	30	15	23	198	,, 286	
,, "Children's"	36	All	0	58	,, 116	
Coventry and Warwickshire	10	7	12	62	,, 110	
Dudley—Guest's Hospital	4	3	9	60	0	
Dudley Dispensary	13	10	6	0	0	
Leicester	44	17	32	210	,, 236	
Stafford	7	3	10	123	,, 518	Water very hard.
Shrewsbury	19	10	19	140	,, 262	Cases frequent on coal-formation; water hard.
Derby	8	0	27	175	,, 691	Water hard in places whence stone-cases come
Nottingham	25	7	33	142	,, 263	Water variable; generally hard.
Lincoln	11	4	32	100	,, 339	Water generally hard.
Stamford	3	2	24	40	,, 425	Water decidedly hard.
Northampton	19	8	27	138	,, 402	Many waters of considerable hardness.
Huntingdon	10	3	36	42	,, 118	Drinking waters unmistakably hard.
Cambridge	33	14	30	120	,, 122	Water hard, containing a good deal of lime.
Colchester	4	1	38	94	0	Town waters hard; in villages rather soft.
Hertford	3	2	19	35	,, 250	Only 5 cases in 20 years.
Ipswich, Suffolk	15	0	0	90	,, 176	Water very hard.
Bury St. Edmunds, Suffolk	9	3	38	84	,, 223	
York	8	3	31	90	,, 442	Cases rare; water soft.
Hull	28	12	30	150	,, 230	Chalk soil; water hard.
Leeds	75	23	33	310	,, 202	Waters variable.
Halifax..................	12	3	39	50	,, 177	Wat. soft; some cases imported from other places.
Bradford	29	8	18	140	,, 141	Water not very hard.
Sheffield	17	7	23	160	,, 369	Not much stone; wat. soft
Sunderland	11	2	20	110	,, 246	Water of moderate hardness.
Manchester	51	12	26	296	,, 302	Wat. of Manchester soft.
Liverpool Royal Infirmary	31	8	26	270	,, 564	Water from various sources; generally soft.
Do. Southern Hospital	6	1	38	200	,, 1192	
Do. Northern Hospital	4	3	6	146	,, 2015	
Lancaster	0	0	0	70	0	No case for 5 years; very rare; water soft and pure
Preston	6	1	47	76	,, 230	Stone cases rare; water soft.
Carlisle..................	6	0	37	52	,, 400	Cases rarely presented themselves.
Devon and Exeter........	6	1	15	230	,, 1298	Water soft.
Barnstaple	3	2	8	100	,, 925	Stone-cases rare; water hard.
Taunton and Somerset ..	0	0	0	92	0	No case for five years; only two in forty years; waters pure and soft.
Bristol Royal Infirmary ..	19	13	12	242	,, 665	
Hereford	2	0	0	74	,, 1560	Two in previous quinquennial period.
Cheltenham	7	4	13	90	,, 395	Water rather hard.
Bath	12	8	14	120	,, 448	Water hard.

TABLE OF STONE CASES (*Continued*).

Hospital or Infirmary.	No. of cases in Five Years.	No. below Ten Years of Age.	Average Age.	No. of Beds.	Proportion of Stone Cases to whole number of In-patients.	Remarks.
Dorchester	3	0	12	60	,, 661	Water slightly hard.
Salisbury	7	1	31	100	,, 714	Chalk and green sand; water not hard.
Ryde	0	0	86	0	0	No case in five years; only seven in 25 years.
Southampton	12	6	22	100	,, 379	
Brighton	22	7	32	165	0	Water very hard from chalk.
Reading	17	5	18	140	,, 298	Water various; generally hard.
Guildford	2	2	4½	54	,, 845	Water hard.
Canterbury	15	0	39	104	0	Water generally hard.
Dover	1	1	6	15	,, 795	Water hard.
Bartholomew's Hospital, Chatham	15	9	16	68	,, 156	Stone common in Kent.
Edinburgh Royal Infirmary	61	10	0	565	,, 353	
Glasgow Royal Infirmary	60	18	25	584	,, 492	Water generally soft and pure.
Paisley	3	1	20	138	,, 1703	Calculus very rare; water soft.
Dumfries	0	0	0	100	0	None; only 11 in 30 yrs.
Aberdeen	47	3	60	300	,, 184	Water generally soft.
Perth	0	0	84	0	0	None; stone very rare.
Dundee	2	2	9	260	0	Both operations on same patient; water soft.
Inverness	0	0	0	120	0	No case in five years.
South Charitable Infirmary Cork	10	3	36	108	0	
Monaghan	0	0	0	60	0	None; only one in 35 yrs.
Limerick	0	0	0	100	0	No stone-case in either of the two hospitals for 10 years; water hard.
Armagh	0	0	0	72	0	No case for many years; water hard.
Roscommon	0	0	0	85	0	Only three cases in 27 years' practice; water hard.
Maryborough	1	0	12	100	0	Only three cases in 20 years' practice; water hard.
Carmarthen	0	0	0	40	0	Stone very rare; no case for more than 7 years; water soft.
Haverfordwest	7	0	55	12	0	See *Lancet*, April 19th, 1873.
Bangor	2	0	12	14	1 to 172	Stone rare.
Swansea	4	0	28	55	— 467	Water pure and soft.
Eight London Hospitals; viz., St. Bartholomew's, Guy's, University College, St. Thomas's, St. George's, Westminster, Charing Cross, Middlesex	280	98	26	2866		

The sources from which the patients admitted into the London hospitals came were:

From London and suburbs	125	From Bucks	8
,, Kent	37	,, Hants	7
,, Surrey	13	,, Yorkshire	7
,, Essex	10	,, Sussex	4
,, Wales	10	,, Lincolnshire	6

Others from scattered places.

Passing now to the second branch of my subject, permit me, before considering the causes of the excess of lithuria in this district, briefly to allude to its etiology and pathology. Although it is safe to assume that, when lithic acid deposit frequently occurs in the urine, there is probably excessive secretion, we must not forget that a diminution of the alkaline bases, or over-acidity of the urine, will lead to deposit, without any relative excess. The conditions of health and disease in which these circumstances obtain are too well known to need notice; but I would ask, as bearing on this inquiry, Whence is lithic acid is derived? and where it is fabricated? Admitting that it is derived from the disintegration of nitrogenised tissues, and from the transformation of the excess of albuminous food, it yet remains a question where or by what agency it is actually generated; whether by the operation of chemical or electro-chemical changes in the blood itself, or in the tissues undergoing change, or by some secreting gland-cells in the liver, spleen, or kidneys. The office of the kidney, with reference to lithic acid, is still a moot question; is its duty simply that of passive elimination? or has it the higher function of constructing and forming the lithic acid, urea, and other principles, out of the materials presented by the blood? Ever since the discovery of urate of soda in gouty blood by Dr. Garrod, there has been a disposition to degrade the function of the kidney, and to allow that it consisted in little more than mere osmosis, and that it simply removed that which already existed. Admitting that urea and uric acid may be formed independently of the kidney, it would seem probable, looking at the fact that healthy blood contains merely a trace of urea and uric acid, and also that, when the kidney is extirpated, these substances do not accumulate in the blood, it would, I say, seem probable that, in the ordinary healthy operations of nature, it is the proper function of the kidney to form as well as to eliminate the 10 grains of lithic acid and the 500 grains of urea which a healthy man voids daily. We know that, in certain diseased conditions of the kidney, the power of eliminating these nitrogenous principles is lost, or nearly so; is it not possible that, in certain other morbid states, the opposite conditions obtain; and that, out of the healthy blood, the morbid kidney may form and eliminate an excessive amount of urea or uric acid? Who has not seen, in persons prone to the deposit of lithic acid, an enormous quantity, almost a teaspoonful, voided in a day? and that without any excess of diet, or sign of extreme waste of tissue, or obvious dyspepsia, or ill-health of any kind. If this excess of lithic acid existed in the blood, *quoad* urate of soda, surely the phenomena of gout would be present; but I have often and so keenly watched this occurrence, and, failing to detect any of the usual etiological causes, it has appeared to me probable that, just as other secreting organs vary in the quantity and quality of the fluid they secrete, so the kidneys, owing to some inherent morbid condition, may form and secrete, out of healthy blood, urine having one or other of its constituents in excess.

But, if, as I have said, there be a tendency to reduce the function of the kidney to that of mere osmotic elimination, I must notice the attempted elevation of another organ, the liver, into what I may call universal supremacy over all the healthy and morbid processes of nutrition and secretion. Not only has it the important glycogenic function and secretion of bile, but it is also credited with the conversion of albuminoid matters from the blood, the food, and the tissues, and the formation of urea and uric acid. Arguing from the fact that urea has been found in the liver, and from some doubtful and controverted experiments showing that rather more urea was to be found in the hepatic than in the portal vein, and forgetful of the other facts, that urea has been also detected in the brain, the lungs, and the spleen, and that only a mere trace is found in healthy blood, we are asked to believe that, out of these three functions, there flows, in chief part, oxidation, sanguification, animal heat, and the depuration of the blood. It makes one almost stand in awe of one's liver, and believe that, having a liver, we could dispense with all other organs of digestion.

But, if the liver be thus comprehensive as to its physiology, what has not been said as to its pathology? Passing by the structural diseases of the liver, which are well recognised and understood, the list of diseases and symptoms arising from mere functional disorder, as set forth by Dr. Murchison, the latest and stoutest champion of the pre-eminence of the liver in disease, is too long even for mention here; suffice it to say, that it includes most of the disorders of all the systems of the body; of the nervous system, of the circulatory, respiratory, cutaneous, and urinary systems and organs; and even such acute diseases as pyæmia and the typhoid state are supposed to be frequently the result of functional disorder of the liver. In my student-days, it used to be said that he who understood the nature and treatment of inflammation had acquired half the knowledge necessary for a successful practitioner. Now, it would be more correct to say, that he who understands the nature and treatment of hepatic diseases has little more to learn.

On this view, gout, of course, is said to be a mere symptom of liver-disorder, and the same is said of lithuria and all calculi composed of lithic acid or its salts; and the practical deduction inculcated by Dr. Murchison and also by Sir H. Thompson is that, in the treatment of gout and lithuria, those remedies which are supposed to address themselves to the liver are to be preferred to those which diminish acidity and dissolve uric acid; that alkalies and alkaline waters are to be laid aside as inefficient, and, at the best, but of temporary benefit, and that saline aperients and waters of that character are alone of real use. To this I would reply, judging from ample observation, that the saline aperient waters are not proved to act specially on the liver; that they probably act chiefly on the stomach and alimentary canal; that they are not so directly capable of removing gout or lithuria as the alkaline waters; and that, when they do so act, they, like the alkaline remedies, are equally evanescent in their effect. I have the conviction that this tendency to exaggerate the influence of the liver in health and in illness displays the drawbacks of specialism in the study of disease, narrows the view to one standpoint, and encourages the old but loose habit of attributing every obscure symptom to a "disordered or a torpid liver." On the whole, it is safer to attribute lithuria to dyspepsia and mal-assimilation, which probably concerns all the digestive organs, than to fix the fault mainly on one.

Undoubtedly, the general dyspeptic condition above mentioned, which, in the opulent classes of society, is generally caused by over-feeding and over-drinking, over-work, and deficient oxidation, and in the poorer classes by other sources of derangement, is the most fertile source of lithuria. This source, however, is common to all places and to most countries, certainly to all parts of the United Kingdom; and yet, as I have shown, there is the greatest possible variation in the tendency to lithuria in various places, and this brings me to the concluding question—What explanation can be given of this variation, and especially of the excess of lithuria in this district?—and when I say excess, I desire to guard myself by admitting that, although there probably is excess, this is by no means proved. It may be that the abundance of stone in Norfolk is due, not to actual excess, but to circumstances which merely determine the precipitation and separation of lithic acid in the urinary tract. Whether it be so or not—and I know no means of deciding that point—the question equally remains. It has often been asked, but never answered, and never argued, except in a negative manner.

One thing appears to me clear and indisputable—the abundance or rarity of the diathesis must depend mainly on local and endemic causes, aided by another agency, which, however, grows out of the endemic cause. Further, these endemic causes must be due to the physical geography of the district, by which is meant the soil, food, and climate; and, when we call to mind how powerful is the effect of the physical geography of a country on the mental character and on the civilisation even of its inhabitants, we may well appreciate, if we cannot always explain, its laws in the production and spread of various diseases. This vast field of investigation has been cultivated by many distinguished labourers of late years, chiefly in the tracing of general constitutional diseases; but its capabilities for the elucidation of particular local diseases is not even now fully recognised; and yet it seems probable that further knowledge in this direction will not only demonstrate the etiology of many local diseases, but will direct into fresh and more accurate lines the study of their pathology, and even lead to more rational means of prevention and cure.

Taking these causes *seriatim*, the climate of Norfolk has by many authorities been thought to be a powerful factor of lithuria. A glance at the map will show how much this county is projected, as it were, into the sea. From Yarmouth to King's Lynn is a very long coast-line, not less than seventy miles. During the winter and spring months, there is a great prevalence of north and east winds; and it is held that these bleak cold winds, by checking cutaneous secretion and deranging delicate digestion, cast additional work on the kidneys and liver, and so derange their function and lead to lithuria. Dr. Prout somewhat favoured this view, and the late Mr. Crosse had a strong belief in it. Rigid investigation, however, will show that climate can have but the very smallest influence. Admitting that cold, drying winds do prevail and are keenly felt in this county to a most unpleasant extent, it is not proved that they exceed those of other places. In the North of Scotland and in many of the exposed parts of Ireland, the temperature must be as cold as it is here, and yet it has been shown that we have almost as many cases of stone as in all Ireland. Moreover, in hot climates, such as India and in some parts of China, stone is not uncommon, while in Sweden and Norway, and some other very cold countries, it is very rare. Again, although it is the fact that we pass more lithic acid in winter than in summer, this is probably due to the greater muscular activity we use in the cold season, and to the consequent greater amount of tissue-metamorphosis. The natural effect of arresting cutaneous secretion must be to increase the amount of the water of the urine by which lithic acid and other solid constituents would be better held in solution, and so the liability to calculous deposit would be diminished; and, *per contra*, the increased cutaneous secretion from summer heat may be supposed to lead to concentration of the urine, and consequently to the liability of lithic deposit. The effect of cold is to diminish the acidity of the urine, and prolonged immersion of the body in cold water is said to render it alkaline. Observation, based on the localisation of 1,500 stone-cases in Norfolk, shows that fewer have come from the villages on the coast, where the exposure to cold is greatest, than from places more inland. These and other considerations which might be adduced did time permit, prove, I think, that climate alone has but little influence in producing lithuria.

The food of the poorer classes in this district, consisting as it does chiefly of good bread, cheese, and a small modicum of meat, chiefly pork, has, however, a speciality which has attracted attention, and has been assigned by many, notably by Prout, as a helping cause of stone. It consists of dumplings made of flour, water, and yeast, which may be described as boiled bread, and are universally consumed by the poorer classes with dripping or treacle. Those who think this article of diet conduces to stone give no other reason for their opinion, than that it is apt to disagree with the stomach and lead to mal-assimilation. I cannot, however, admit the impeachment against the popular dumpling, for I do not believe that it is hostile to good digestion; is is never referred to by patients as a probable cause; and, when stone-cases are admitted into the hospital, although in all instances remedies are prescribed of a nature likely to check lithic deposit, I never heard that the dumpling, which is a part of our hospital dietary, was forbidden. There is, however, one article of food, viz., milk, the want of which, in my opinion, does influence the development of lithuria very largely. More than twenty years ago, it attracted my attention, and I dare say that of others, that stone in the bladder, which, in the young children of the poor, is so common as to constitute more than half the whole number of cases, is seldom or never met with in the more opulent classes of society. In some hundreds of cases of stone which have passed under my own observation, I have met with but one occurring in a child under 5 years, whose parents were well-to-do in the world; and this experience has been corroborated by all those surgeons of whom I have made inquiry. To what is this marked contrast due? Mr. Thomas Smith, in a paper on the subject (BRIT. MED. JOUR., vol. i, 1869, p. 442), summed up the probable explanation by attributing it to "insufficient and almost arrested cutaneous excretion from imperfect clothing and uncleanliness, tending to disturb the due proportion of the normal constituents of the urine, and lead to a relative or absolute excess of some one constituent; while the digestive organs of poor children are constantly liable to disarrangement from unsuitable food or from irregularities in their mothers' diet." Agreeing in the main with this account, I would go further, and say, that the prevalence of stone amongst the children of the poor is largely due to the impossibility of their obtaining a proper and sufficient supply of sound milk; the insufficient clothing and uncleanliness referred to probably exist everywhere, in Ireland and Scotland as much as in England, and yet Ireland has but little stone as compared with England. Again, in the table of hospital cases which I have compiled, the most remarkable differences with regard to stone in children appear. In the midland counties, a large majority of the cases are in young children, while in Aberdeenshire, where stone in the adult is common, there are but very few cases in children. In Yarmouth, a town on the east coast, fifteen out of twenty-one were under 10 years of age, while in Aberdeen, which is similarly situated, there were only three cases out of forty-seven under 10 years. Referring to Dr. Edward Smith's report to the Privy Council on the food of the labouring classes, it appears that, in Ireland, Wales, and Scotland, the poor obtain an abundance of milk, while in Warwickshire, Norfolk, Suffolk, Kent, and other places, very little is obtained. I am warned by time that I may not go more into particulars on this subject; but I affirm that strict inquiry shows that the abundance of stone in children of urban over rural populations, and of one district over another, will be found in strict accordance with the difficulty of procuring milk. The one exception mentioned is very corroborative of this view. A few years ago, after removing a stone from a child of well-to-do parents, I was remarking to one of my assistants that this was the first instance in my practice, and that I attributed the general absence of stone to milk; the mother volunteered the statement that, in a large family, this was her only child who never could take milk, and who, therefore, never had any. To this lamentable want is chiefly due not only this disease of stone, but probably a vast many of the diseases which attend the early years of childhood; which are prolonged into after years of imperfect development and early decrepitude. If ever true wisdom was combined with much false political economy, it was when John Stuart Mill maintained than those who live and labour on the soil have rights in the products of the soil beyond that of mere wage. It would, indeed, be a glorious result of statecraft if, instead of the futile wrangling over the sale of fermented liquors, which has wrecked one powerful Government, and, by the disappointment of greedy expectants, has gone far to sap the popularity of its successor;—if, I say, by some equitable enactment, those who possess and those who occupy the land should be held responsible for the production, in sufficient abundance for the wants of the poor, of that which is now a costly luxury, but which nature points out to be the chief, I may say the only, need of early childhood.

One other fact connected with the food and beverage of this district deserves mention. The light but fertile soil of Norfolk is peculiarly adapted to the growth of barley, and I believe I am right in assuming that this is one of the greatest malt-making districts of the kingdom. One effect of this is, that beer is the common beverage of all classes. The labourer seldom touches spirit of any kind, but his libations of strong, sweet, new beer are liberal and often deep. The effect of malt liquor in provoking gout and lithuria is undoubtedly great, and, if we contrast the beer-drinking Norfolk peasant with the milk and whiskey-drinking Irishman, we shall probably be right in attributing somewhat of the prevailing lithuria to this habit.

Associated with the soil is the geological structure. Stretching diagonally across the south-eastern part of the kingdom, is the great chalk-formation, and Norfolk may be considered almost its centre. Close beneath where we now stand there is a thousand feet in thickness of chalk ; it crops out on the surface, is visible in every pit, and impregnates the superjacent deposits where itself dips deep. Corresponding to this south-eastern chalk-district, there will be found a large amount of lithuria ; both the death-rate and the hospital records combine to prove this, and I have the conviction that a more minute inquiry than I have been able to make would demonstrate even a still closer relation than I have been able to show. What reason can be assigned for this striking correspondence? The only probable cause that I can discover lies in the character of the drinking-water, and the only peculiarity of the drinking-water is its excessive hardness. That there is an excessive amount of carbonate of lime in water derived from the chalk, will probably be readily allowed. Mr. Sutton, the eminent chemist of this city, has given me the analysis of eighty different sources of water, chiefly well-water, from various villages of Norfolk, and I find that the average hardness is 33 deg. of Clark's scale; while, from forty Government analyses of water from different towns, the average hardness is 11 deg., and, from sixty-five different sources supplied to Government by Dr. Letheby, the average hardness is 9.2. I am aware that water supplied by public companies is generally less hard than that derived from wells; and I admit that we are not in possession of sufficiently detailed analyses of local sources of drinking water to justify very close deductions. Still the broad fact remains, and I know no other peculiarity likely to act as a probable cause. The drinking of hard water has long and often been held to influence the production and growth of stone; but I know of no explanation or argument in favour of it, except that of Prout, who says, "that hard waters, in conjunction with other favourable circumstances, have a great influence in producing stone, I have no doubt ; they derange delicate stomachs very considerably, and have a tendency to produce lithic sediments, though they generally act by causing a deposit of the crystallised sediments or gravel in those disposed to them." I am not competent to discuss the chemical action of lime-salts in leading to lithic acid deposit ; but I note the fact, that both lime and lithic acid are exceedingly insoluble; that there is no chemical affinity between them ; and that, although lithate of lime has been said to exist in the mixed lithates so often seen, no calculus has ever contained it. Is it not, therefore, possible that the constant filtration of lime in excess through the system may encourage the separation and deposit of lithic acid in the urinary passages? In seeking information on this point, I inquired of all my correspondents as to the hardness of the drinking water in the various districts, and I found very varying statements ; many were sceptical as to its having any influence; but the balance of evidence was in favour of stone-cases being connected with hard drinking water. I have seen so many instances of persons who have come to reside in Norfolk rapidly acquiring the lithic diathesis ; of others who lose the tendency immediately they leave the county, and of others whose tendency varied with their residence even in the district while the habits of living have remained the same ; that I know not how to doubt the effect of the drinking-water on them. Against this view, it has been urged that, if hard waters had any effect, they would show it in males and females equally; that hard waters prevail largely over soft in most places, and that the drinking of hard waters predisposes rather to the oxalic and phosphatic than to the lithic diathesis. In reply to the first objection, it may be said that all influences act more powerfully on men than on women, and that renal, if not vesical, calculus is frequent amongst women ; that, although three-fourths of all drinking-waters may be hard, the waters coming from the chalk may have some special peculiarity, and that, in other places, as in Ireland, the hard waters may be counteracted by other favourable circumstances of food and drink. Moreover, in the midland districts, where, I believe, the water is very hard, I have shown that stone is also very prevalent. As to the effect of hard water in leading to the oxalic or phosphatic diathesis, as described by Dr. G. Harley and Dr. Murray, I can only say that, in my experience, it is not the fact in this district. I have now operated for stone in nearly 200 cases, and I can only call to mind three cases in which oxalate of lime calculi were removed from adults, and these cases were curious ; in one, the central half of the stone is pure uric acid, and the outer half oxalate of lime; and this patient left Norfolk, probably with an uric acid stone in his bladder, to reside in North Wales, and immediately the uric acid became covered with oxalate of lime ; the second case was in a Norfolk man, who also had resided out of the county ; and the third was a private in a Dragoon regiment, who had very recently come to live here.

I leave this question of the effect of hard waters, therefore, as an undecided one, requiring fuller investigation, and especially the tracing the absence or prevalence of stone in other countries and connecting it with local influences or endemic causes.

Lastly, I have to say a few words on hereditary tendency and family predisposition as a cause of stone in this country ; and here I cannot help believing we have an influence acting slowly but potently. I can understand, and would maintain, that the hereditary influence must be but slight as to its immediate effects, and must probably require the other favouring influences mentioned to act at all ; but with them, in the course of generations and centuries, it would probably so grow and develop as to create in part the admitted abundance. Let me put the proposition in another way. Could we remove the present population of Norfolk into Ireland, and import the same number of Irish into Norfolk, it is probable that no great change would quickly follow in the respective manifestations of the lithic diathesis ; but it is most probable that, in course of time, owing to the absence of endemic influences, the Norfolk diathesis would not maintain itself in Ireland, and the Irish substitutes here would as certainly acquire our tendency. I cannot appeal to statistics on this point, and therefore I may be excused for again referring to my own experience. I have never operated on a father and son, but I have very often traced the disease back to father and grandfather. In five instances, I have operated on brothers; and in four other instances I have operated on one brother, and other surgeons on another. Mr. Clubbe, of Lowestoft, has given us a curious history of a stone-family. Three brothers were cut for stone by Mr. Clubbe ; a fourth passed a stone ; a fifth child died, aged three months, with every symptom of stone; a female child now has vesical irritation and bloody urine. The father and mother are constantly passing large quantities of lithic acid; the grandfather passed one stone, and the grandmother seven ; a great-uncle was cut for stone, and six uncles and four aunts all suffer either with fits of gravel or from lithic deposits ; and, to finish, a cousin passes calculi. (See *Lancet*, July, 1872).

There is considerable historical testimony in favour of this hypothesis. We know that Montaigne and his father both died of stone in the bladder, and we remember how he moralises on the incomprehensible wonders of the hereditary transmission of mental and bodily resemblances and infirmities. The celebrated minister Sir Robert Walpole, and his brother Horace (who once represented this city in Parliament), were both afflicted with stone, and both resided in this county ; and their mother also had stone.

What we know of the genesis and growth of stone would lead us to acknowledge both constitutional and local causes; and there is surely as much inherent probability in favour of its hereditary transmission as in that of gout, of cancer, or of scrofula. The difficulties in the way of admitting this influence in one case equally, or nearly equally, exist in the others, and are principally those which beset the whole question of inherited predisposition to disease. Dr. Richardson, indeed, objects to this theory, on the ground that stone is far less frequent in females than in males ; whereas the tendency, he says, from the parent should pass alike to male and female. To this it may be replied, that the same influences which govern the transmssion of gout chiefly in the male issue are equally dominant in the case of stone ; and these influences consist in the harder living and the harder life, the greater exposure, and the rougher work of men beyond women. Besides, although the relative proportion of *vesical* stone in males and females is about 25 to 1, it is far less disproportionate as regards *renal* stone. I cannot, of course, give the relative proportion in the latter case ; but it is unquestionably the fact, that renal calculus in the female is common in this district.

Time warns me to conclude. Permit me to sum up by saying that in every part of the British Isles there is, so to say, a film of lithuria; that constitutional and individual causes act everywhere ; that, in some places, local and endemic influences co-operate to thicken the film into a decided layer; in others, the constitutional tendency is counteracted by the local conditions. In this particular district, the local favouring influences consist, to a very trivial degree, in the cold climate ; in the universal consumption of malt-liquor ; possibly, I will even say probably, in the constant daily use of exceedingly hard drinking-water ; and, lastly, in the accumulated effect of hereditary predisposition.

I cannot, however, pretend, in what I have written and read to-day, that a full and complete explanation of a very interesting and important fact is to be found. The subject is so abstruse in itself, so mixed up with profound physiological and chemico-vital processes, so intimately associated with what essentially we know so little about—viz., the nutrition, the growth, and the decay, of tissues and organs—that, in the present state of knowledge, we must, I fear, admit our darkness, and search and strive for increased light. I may, however, hope that I have stimulated, if I have not satisfied, the desire for fuller information ; and if, by the help of such additional facts as have been adduced, and by the exposure of some errors and vague theories, the future search for truth may be made easier, I am content to believe that towards this end I have made a slight contribution, and have not wholly wasted a golden opportunity, or overtaxed your indulgent patience.

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